Agricultural Schools in Europe.

FROM THE

REPORT OF THE SECRETARY

OF THE

Massachusetts Board of Agriculture.

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These schools are of two kinds. Those which are connected, either directly or indirectly, with universities, and those which are independent of other institutions. With the former there is, in most cases, an experimental farm for the purpose of illustration and instruction, though the students are not expected to work on it; but in some cases it consists of a simple professorship, as at Edinburgh. With the latter, the higher institutes do not invariably expect the students to labor, though this is sometimes the case; but the location is, nearly always, if not invariably, upon a large estate, where the students can work or not, as they choose, the farm being carried on by hired labor or by students of an intermediate or lower school of practical agriculture connected with it.

I visited many of both descriptions, introduced myself to the professors, mingled with the students, attended lectures, joined in excursions, and in every way attempted to make myself familiar with their practical working and efficiency.

INSTITUTE AT JENA.

As soon as I arrived at Jena I visited the laboratory and collections, was introduced to the director, Dr. Stöckhardt, and was politely entertained by his agreeable family. He very kindly placed much information in regard to the school at my disposal.

The Agricultural Institute at Jena is designed to educate young farmers, political economists and financiers.

For such young men, especially, as have already spent some time in the practical operations of farming on large or medium-sized estates, it offers an opportunity to educate themselves scientifically in their department. But for such as will prepare themselves for political economists and financiers, it offers that special instruction in agriculture which is essential to them.

Connection of the Institute with the University.—The institute is an integral part of the university at Jena, and is under the same government. The director and most of the professors are also connected with the university; those who enter the institute for farmers are matriculated as students at the university, and attain thereby all the rights, and assume also all the responsibilities of academical students, the same as in any other department of the university.

The advantages which the institute gains through the union with the university, pertain in part to the means of instruction, and in part to the spirit of the academical life.

To the means of instruction of the university which the members of the institute can enjoy, belong, besides the lectures on those parts of natural science and political economy which are not to be had in an isolated institute, and the lectures upon mathematics, philosophy, history, general law, &c., the library, the botanical garden, the mineralogical museum, the zoölogical cabinet, the observatory, the gymnasium, the riding, swimming and boxing schools, &c.

In consequence of the use of these means of instruction, the institute stands in an independent relation with the university, which secures it great advantages; yet far more important is the more intimate connection with it, that is, the necessity that its instruction of the same principles should be more general and comprehensive, and fundamentally scientific, like that of the university, that the institute, through an intimate sympathy in the emulation of the university students, and in connection with them should realize the idea of German university life, and thereby advance the higher education of students in agriculture and political economy.

Objects of Instruction.—The sciences useful to the farmer which the institute teaches, are as follows:—

1. Sciences relating to the branches of agriculture. Sciences bearing on the cultivation of agricultural plants, in its whole range, as climate, soils, cultivation, tillage, manuring, seed, after-culture, harvesting, culture of grains, mercantile and fodder plants, fruits, &c. The breeding of animals, in its whole range, the principles of breeding, nourishment and care, raising, keeping and use of particular sorts and races of domestic animals; farm management, with all its branches,

book-keeping, valuation, &c.; agricultural excursions, demonstrations and conversations.

2. Fundamental and auxiliary sciences of agriculture.

National economy, agricultural history and statistics, agricultural law, physics, meteorology, general chemistry, agricultural chemistry, practice in the laboratory, qualitative analysis, quantitative demonstration of agricultural materials, grains, oil fruits, guano, other kinds of manures, soils, plant ashes. Mineralogy and geognosy, including knowledge and classification of soils. Botany, with special reference to the physiology of plants; including botanical excursions, instruction in forestry, care and use of woodlands. Gardening. Zoölogy, with special reference to knowledge of insects. Veterinary science, anatomy and physiology of domestic animals on the farm; pathology and therapeutics, chirurgery, shoeing, &c. Mechanics and machinery, agricultural machinery and implements, their construction and use. Agricultural technology, distilling, brewing, sugar making, bread making, manufacture of vinegar, including technological excursions. Geodosy, use of the surveyor's chain and theodolite, field measuring, levelling, agricultural mechanics.

The arrangement of these various branches is such, that those bearing on agriculture, national economy and the natural sciences generally, are repeated annually, some of them twice a year, and others only every two or three years.

For the ancient and modern languages, the fine arts and all gymnastic exercises, the university offers extraordinary opportunities to those who desire it.

Besides the above-named lectures, excursions and conversations, the institute offers all essential means of instruction, such as the public domain at Zwätzen and Lehesten, embracing about 1,400 acres; with a numerous herd of cattle, a distillery, brewery, and silk-raising establishment, which serve as means of illustration;

An agricultural botanic garden, attached to the botanic garden of the university;

A well-appointed chemical laboratory with a sufficient number of convenient working desks;

Collections of minerals and earths, dried plants and seeds, models of fruits, collections of insects, technical apparatus, so far as requisite for reference in the lectures;

A valuable agricultural library for the use of the students;

A reading room where all the agricultural papers are taken;

An infirmary for sick animals, with a room for operations and necessary tools;

A rich collection of pathological preparations and objects.

Special lots are set apart for experiments. Besides this there is a government experimental station at Jena. The object of this is to develop the natural laws which relate to agriculture, through scientific investigations and experiments conducted in the most scientific manner. It is requisite that young men should learn how to institute and conduct scientific investigations.

Kind of Instruction.—The university is distinguished from other institutes of instruction, less through what it teaches than the mode adopted. The agricultural institute is a constituent part of the university and must be an active member of its organism, and therefore it must maintain a mode of teaching consistent with the claims of a university, that the instruction imparted may incite to self-activity; that the student may attain, by the wise use of academical freedom, the objects of his college course, as far as possible, through self-culture; and he may, as far as possible, be thoroughly educated, not in one or two branches, but in all. So far as regards instruction in agriculture, the professors strive to make it enthusiastic, intelligible and practical.

Course of Instruction.—The course of instruction in the principal sciences can be completed in four half-yearly terms, but the student is advised to pay more attention to auxiliary branches, which require a three years course. But the subjects are so arranged that new members can enter twice a year, in spring and in autumn. Every one on entering is expected to make known his objects and intentions, and the time he can devote to theoretical studies.

The beginning and ending of the institute lectures are governed by the terms and vacations of the university, and public announcements are made through the public journals. They generally begin at the end of April and the end of October. The members of the institute devote their vacations to agricultural excursions or to a visit to some landed estate. The students can room in the buildings of the university, or in private houses in the city.

The cost of tuition for agricultural students is, for the first term, 64 Prussian thalers, or $40.50, for the second, $36, for the third, $18, for the fourth, $4.50. There is a matriculation fee at the university of about $5, a half-yearly lecture fee of 75 cents, a payment to the treasury of a hospital society, a sort of insurance against sickness, of 25 cents, and a few other small regular sums to be paid, including the diploma on graduation, of $1.62½. Then, if the agricultural students attend any of the strictly university courses of lectures, they have to pay the same fees as other students. For lodging, including study and sleeping room, furnished with sofa, chairs, table, bed and other necessary articles, and attendance, from $7.50 to $15 a term. For heating and lighting, in winter, $7.50 to $12; also $1.50 for "boots," and $3 to $5 a term for washing.

The candidate for admission must bring a certificate from the magistrate of the place where he has last resided; a consent of father or guardian to enter the institute; a certificate of his teachers, and an explicit description of his past life. He must have sufficient knowledge of elementary studies and the German language to understand scientific lectures, but no formal examination is required on admission.

An attendance at a high school, or a polytechnic school, at least up to the higher classes, or at some practical school, and one, two or three years passed in practical work on a farm, is recommended as a preparation for admission to this institute.

The following is the arrangement of lectures at this institute:—

Hours of the Lectures in the Agricultural Institute of the University of Jena, Summer Term, 1863.

HOURS.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
7 to 8, .	Botany.	Physiology of Plants.	Botany.	Physiology of Plants.	Botany.	Physiology of Plants.
8 to 9, .	General Chemistry, Chemical Technology.					
9 to 10, .	National Economy.					Architecture.
		Science of Finance.				
10 to 11, .	Experimental Physics.					
	Introduction to the Sciences.	Veterinary Science.	Politics and Government.		Veterinary Science.	
11 to 12, .	Encyclopædia of Agriculture.		Agricultural Mechanics.	Sheep Breeding and Wool.		Field Measurement.
2 to 4, . .	Work in the Chemical Laboratory.					Excursions.
4 to 5, . .		Horse Shoeing.	National Economy.		Farriery.	
5 to 7, . .	Surveying.	Valuation.	Latest Agricultural Improvements.	Valuation.	Surveying.	

Excursions and demonstrations, as well as veterinary illustrations, are appointed by the Director at stated times.

The investigations in the chemical laboratory take place daily from 8 to 12, A. M., and from 2 to 4, P. M., except on Saturdays. Beginners work only on Mondays, Tuesdays and Wednesdays in the afternoon.

Students in Mathematics attend lectures on elementary mathematics, Mondays, Tuesdays, Thursdays and Fridays from 6 to 7, A. M.

There are eleven professors and instructors of the institute. The number of students is at present one hundred and ten, ranging in ages from 18 to 21 years, I should think. The

SCHOOL OF PRACTICAL FARMING

is at Zwätzen, but a short distance off. In that the sons of peasants are educated, and they have to work their way.

The general oversight of this practical school resides in the Ministry of the Interior of the Grand Duchy, the direction is committed to Prof. Stöckhardt, of Jena, and the immediate management to a superintendent on the place.

The object of the school is to give its pupils an education which will fit them for the skilful practical management of middling-sized and small estates.

The course of instruction extends over two years, and is devoted to the following objects: Religion, the German language, arithmetic and geometry, drawing, singing, geography and history; physics and natural history, agriculture, meadow management, fruit and garden culture, cattle-breeding, instruction in the carrying on of the farm in the most skilful manner, book-keeping, agricultural mechanics, and field measuring.

The division of these objects of instruction is so arranged that in addition to the school studies comes teaching in general preparatory sciences and the different branches of agriculture. Besides suitable means of instruction, is the opportunity of observation on the estate at Zwätzen, and the advantage of veterinary lectures and teaching in the Veterinary School at Jena.

The employment on the land belonging to the school, which has recently been increased, as well as in the workshop for the manufacture of agricultural implements, serves as a practical illustration of the instruction in the school, and as a means of preparation for the future calling.

The pupils live with the family of the superintendent and his assistants, and all eat at the same table. They are expected to have had some practice in farm labor on admittance. Natives pay 80 thalers or $60 a year, others $75, for instruction, lodging and board. The admission of new students takes place in the spring and fall.

Here is a notice translated from the printed circular, or programme: "Every pupil, as he enters, has to bring with him a bed, with three coverlids,—the school furnishes bedstead and mattress,—one Sunday and two week-day suits, a trunk to keep his clothes and linen in, 6 shirts, 2 pairs of stockings, 6 towels, 6 pocket-handkerchiefs, 2 blue aprons, 2 pairs of boots, a pair of slippers, a comb, a wash-bowl, 2 plates, a couple of knives and forks, a spoon, a couple of cups and saucers, clothes and shoe brushes,—all to be marked, if possible." It's a convenient thing to have one's wardrobe so minutely specified.

As I have alluded to the agricultural school at Jena, connected with the university, I will also say a word in regard to one or two others of the same class; that is, connected in a similar manner with other institutions.

POPPELSDORF, NEAR BONN.

The agricultural college at Poppelsdorf, connected with the university at Bonn, I had taken in my trip up the Rhine. It is some ten miles above Cologne, beautifully situated on the left bank of the river, within sight of the far-famed Siebengebirge, or seven mountains, and the Drachenfels. Bonn is beautified by the most attractive terraces along the river, and a magnificent avenue leading to Poppelsdorf, nearly a mile, studded with superb chestnuts in double rows, on either side.

I called at once on Dr. Hartstein, the director of the agricultural school, who kindly gave me the information I sought in regard to its present position and prosperity. Close by his house is an ancient castle, now used as a depository of the extensive scientific collections belonging to the university, to which the students in agriculture have access. The model farm of the agricultural institute is also close at hand. This is used for the purposes of experiment, and the crops on the experimental plots were very striking. Extensive mulberry hedges surround the fields, and the silk-worm was in the full tide of successful operation.

The scientific lectures extend over not only the branches requisite in the department of agriculture, but also the fundamental and auxiliary sciences connected with it, viz.:—

(*a.*) Agriculture in its whole range as a leading science, and especially

1. The science of tillage, which is divided into a general and special branch. In the one are the knowledge of soils, manures and the working of the land, the seed, care of the crop, and harvesting of agricultural products in general is taught; in the other, more exact instruction is given, as to the judicious cultivation of each one of these products. In this connection the formation of permanent meadows, and especially artificial meadows, is considered.

2. The science of cattle breeding, or the production of animals, which also includes a general and a special course. In the first, instruction is given as to the different races, the pairing, breeding, feeding, care and fattening of cattle in general; in the second, the breeding of cattle, sheep, horses, swine, &c., in particular.

3. The proper farm management, taking in the whole agricultural profession, and including general rules and principles. The principal divisions are, the objects of agriculture, land, capital and labor, sale and leasing of estates, different systems of agriculture, the arrangement and direction of farms, and of taxation and book-keeping.

To these lectures upon agriculture are added those on fruit management, garden, fruit and vineyard culture.

(*b.*) Chief and auxiliary sciences.

1. The natural sciences, chemistry and physics, zoölogy, botany and mineralogy, with special reference to agriculture, and so far as they are of importance, to the farmer in the oversight and judicious direction of his estate.

2. Mathematical sciences, especially applied geometry, stereometry, statics, hydrostatics and machinery connected with the practice in field measuring, levelling, drawing of plans, &c.

3. Popular agricultural literature, so far as it serves as a safe ground-work for practical agricultural instruction.

4. Agricultural technology.

5. Veterinary science.

6. Agricultural mechanics.

7. Laws relating to agriculture and the cultivation of lands.

8. History, statistics and literature of agriculture.

The farm connected with the institute serves for practical illustration, as well as the excursions which, from time to time, are taken in the neighborhood, and during vacations, also, into more distant regions. The institute is in want of no auxiliary means of making the theoretical and practical instruction most useful. Among these are the chemical laboratory, erected especially for agricultural investigation, the physical apparatus and the instruments for land measuring and levelling, the collection of minerals and ores, the zoölogical and veterinary collection, the collection of models and implements, and of wool, the library, the economic botanic garden, the botanical collection and the estate, with the experimental fields and the vineyard. Besides these peculiar means of instruction of the institute, the use of the rich collections and apparatus of the university, the royal university library, botanic garden and natural history museum, is available.

Students pay an entrance fee of six thalers, and a fee for tuition of forty thalers, or thirty dollars, for the first term. The amount for the second term is thirty thalers, the third twenty and the fourth ten, making the fee for the whole course of two years, one hundred thalers, or seventy-five dollars.

The lectures embrace a two years' course, the terms being arranged to conform with those of the university. The special plan of instruction is made known each term. The school is designed for those who desire to educate themselves for skilful farmers, and those who devote themselves to the studies of the university, and at the same time wish to become familiar with the operations of agriculture. Students who are entered at the university of Bonn, and enrolled in any of the faculties, can attend the agricultural lectures on application to the director.

Applicants have to bring certificates of good conduct. No proof of specific attainments in elementary school studies is required, but it is desired that, before visiting the institute, the pupil should be familiar with the practical manipulations of farming, and be able to show proof of it.

On admission, the student is matriculated and enrolled in the faculty of philosophy at the university. By this he acquires all the rights and undertakes all the obligations of the university students.

The whole establishment is under the control of the royal ministry for agricultural affairs at Berlin.

The experimental farm, close by the school, contains, I believe, about seventy acres. I visited the barns and out-buildings, all of which appeared to be in admirable condition, a place for everything and everything in its place.

But seven or eight cows are kept, and those are all Dutch, which are thought there to be among the best for milk. No experiments appear to be made there to test the comparative merits of different breeds. A long series of experiments in the fields near the house seemed to be conducted in the most careful manner. Many of the plots of wheat were of extraordinary growth. A great variety of plants are cultivated, chiefly for the purpose of instruction.

I visited Gissen, Göttingen and Halle, with each of which universities there is an agricultural department connected, but they do not differ materially, so far as I could learn, from those at Jena and Bonn.

GEISBERG.

The agricultural institute at Geisberg near Wiesbaden is the principal if not the only one of the kind in the Duchy of Nassau. I visited it in July. It stands on an elevated plateau overlooking a most enchanting region of country, with the fashionable invalid resort of Wiesbaden close by, while at a little distance rolls the winding Rhine between its vine-clad hills. The celebrated vineyard of Johannisberg is not far down the river. This school differs from most others in giving instruction only in winter.

It is on the isolated and independent plan, and is designed for the instruction of practical farmers, without teaching practice on the place. Applicants must be sixteen years old, possess a good elementary education, and a good "character." They have to bring a written certificate of willingness on the part of the parent or guardian that they should enter the school, and it is expected that pupils shall have spent one or more summers in work on the farm before they enter. If the requisite certificate of proficiency in the elementary studies cannot be produced, or if it is not satisfactory, the applicant is examined, and either rejected or accepted with conditions, not

unlike the practice in entering Harvard College, where comparatively few get in without "conditions."

Each pupil is required to attend all the lectures; but they have a class of pupils as they have at Hohenheim, called *hospitanten*, or students who take only the partial course.

The theoretical instruction is given in a regular course of two winters, the term beginning on the fifteenth of October of each year, and ending on the thirty-first of March. During the intervening summer they are either at home, at work on the farm, or, if they desire it, the director of the institute procures them suitable places with skilful practical farmers.

Natives of Nassau pay no tuition. Outsiders pay forty-four florins, or about eighteen dollars, a year. All the pupils board in the town of Wiesbaden. The instruction is by lectures and written and verbal questions on the studies. After the return of the students from their summer's work on the farm, they are required within six weeks to present a full written detail of operations, which, after suitable corrections, are returned to the writer.

The parents or guardians are informed, from time to time, of the industry and conduct of the pupil. Gambling, so fashionable and exciting at Wiesbaden, is forbidden, and no student is allowed to smoke or to keep a dog.

The institute possesses a library, which appeared to be tolerably well stocked, very good collections and fine lecture and study rooms. It is on rather a small scale as compared with some others, though it may be called one of the superior class. It was founded in 1835, and, as may be inferred from what has been said above, on the principle that it is of no use to try to teach the theory and practice at the same school. There is a small farm connected with the school, but, judging from the helter-skelter, or generally mixed-up condition of everything about the premises, I should think they were quite right in not attempting to teach practice there. Old ploughs, drags, carts, harrows and every thing else lay around the buildings in no small confusion. When I drove into the yard I felt sure we had made some mistake, and had got upon the premises of a very slovenly farmer, but the driver was sure he was right, and the result justified his topographical knowledge. The farm buildings are irregular and crowded, not large or imposing, but

rather ordinary in every respect, though the building used by the students and the collections was better.

These collections consisted of minerals, birds, quadrupeds, seeds, grains and grasses, and a fine collection of wax fruits.

The instruction embraces, in the first term or winter, the German language, arithmetic, botany, mineralogy, physics, general agriculture, cultivation of meadows, rural architecture and veterinary science. In the second winter the boys take up zoölogy, physics, farm accounts, special agriculture, special zoötechny, horticulture, technology, veterinary medicine and composition.

The director had left for the International Exhibition at Hamburg, so that I was obliged to find my way about without much assistance. The price of farm labor there, I learned, was thirty-six kreutzers, or twenty-four cents, a day, the men boarding themselves.

HOHENHEIM.

Many a grand enterprise, like many an illustrious man, grows up from small beginnings. Schwertz, who may be called the founder of the agricultural school at Hohenheim, began its direction towards the close of the year 1818, with only eight pupils, six of whom were natives of Würtemberg, and two from abroad. It is now generally admitted, and I think with justice, to stand at the head of the institutions for agricultural education in Europe. I propose, therefore, to enter, to some extent, into the details of this establishment, and to dwell upon them at length, even at the risk of being tedious.

I arrived at this celebrated agricultural institute on the 29th of July, and took a room, such as is occupied by the students, in the building, prepared to stay some days, or till I could "get the hang of it." It was a strange feeling that came over me at first, in the midst of a crowd of rollicking German students, rooming among them, eating with them, and mingling with them in their walks, in the lecture room, and in the long corridors of this quaint old ducal palace, a monument of the wealth, the luxury and the morals of a century ago, on which hangs a tale, which I have not time to unfold.

Hohenheim is some seven or eight miles from Stuttgart, the capital of the kingdom of Würtemberg, the road lying through

vineyards and orchards and royal forests. Long before my arrival at head-quarters it was easy to see that I was riding through the fields of the institute. The fruit trees were labelled and numbered, the fields and the rotation upon them, were indicated by stakes and cards, and everything gave evidence of thrift and skill and scientific management. What capital roads! Nothing but a royal decree could have lined them everywhere with cherry and apple and pear trees, stretching away as far as the eye could reach. No fences mar the open landscape, either along the highway or on the division lines. There is a little foot-path that leads through the woods, a beautiful, shaded walk to Kleinhohenheim.

But here we are at the very door, at this fountain-head of agricultural science. I introduced myself at once to Professor Rau, whom I already knew well by reputation, and found him quite free to communicate all the information in his power; to accompany me to the various parts of the establishment and the farm, and to give me access to the lectures which should take place during my stay. He placed in my hands a beautiful royal octavo, which had just appeared, a *Beschreibung der land-und forstwirthschaftlichen Akademie Hohenheim*, containing many illustrations and historical sketches of the estate, the course of instruction and management of each department, the experiments and the stock, and to this, and the other documents which he gave me, I am indebted for much of the information I am about to present, in regard to this school of agriculture.

Hohenheim really consisted, for some years, of three quite distinct schools, which, though erected on the same estate, and, as it were, under the same roof, were, and still are, as independent of each other, in most respects, as if at opposite ends of the kingdom.

1st. The institute or school of agriculture, for young gentlemen.

2d. The school of forestry.

3d. The school of practical farming, for the sons of peasants.

The lands, plantations, gardens and nurseries connected with the old chateau are wholly devoted to the purposes of the three establishments, and serve professors as well as pupils for illustration and experiment; while the extensive royal forests in the neighborhood and lengthy excursions made every year, give a

wide range of observation, especially for students in the management of forests.

The agricultural institute originated, in a measure, from the establishment of the agricultural society of Würtemberg, in 1817, when the necessity of a model farm and an institute of instruction and experiment became strikingly apparent, as a means of the development and the elevation of agriculture in the estimation of the people.

The success and popularity of the school, founded in 1806 by the illustrious Thaer, at Möglin, in Prussia, had no doubt contributed largely to this feeling among the agriculturists of Würtemberg. Thaer's enterprise was undertaken at first on his own private account, and so continued till the year 1819, thirteen years after its commencement. It so happened that the introduction and spread of fine-woolled or Merino sheep into Northern Europe, and especially upon the farm at Möglin, near Berlin, concurred to attract to this private effort a large share of public attention, while the reputation of Thaer rapidly grew at home and abroad, not only as a consequence of the success of his school, but likewise from his valuable publications. His school was therefore taken under the patronage of the government, as a royal academy, but the management of the estate still remained at the risk and expense of the owners, the instruction only being paid by the government. This led to a mixed arrangement, the evils of which very soon began to develop themselves, and in time to be avoided at Hohenheim, where the whole establishment was taken under the control of the government, and located upon a royal domain.

A part of this domain happening, at that time, to be under lease, it was necessary to begin the instruction on the small adjoining estate of Carlshof, consisting of only 255 acres. A small beginning was therefore a matter of necessity, and this was to continue till the year 1822, when the broad estates of Hohenheim would be at the service of the institute, at the head of which stood Schwertz, who was placed, by the confidence of the king, in full control of the property, with only the assistance of a farm inspector and two of his pupils. He personally arranged everything, and even managed the finances of the school, which, for the first two years, remained on this simple foundation, as a purely agricultural institute. But in the year

1820, the school for the management of forests, which had previously existed at Stuttgart, was removed to Carlshof and placed under the direction of Schwertz, though still independent for all the purposes of instruction. The greater number of students were then, as they are at present, students of agriculture. Last year ('61–62) for instance, there were 124 agricultural students and but 37 foresters.

The limited number of foresters may be owing in part to the rigorous conditions of admission to the forest school, the applicants for which must have practiced in the management of woods for at least two years under a head steward of forests. It was thought that a general connection of instruction in forestry with that in agriculture would have some important advantages, as, for instance, for the pupils of the agricultural institute, who are either owners or to become, in future, stewards of large estates, in which the management of forests would often be of great importance, while the contact of a class of students who have to submit to a rigid examination on which their future success will largely depend, would be very useful as an example of good conduct and studious habits, to students in the agricultural institute who are not obliged to work. It would be a desirable stimulant to exertion. Then the union would enable the two to give a wider range to the instruction in both, the students of each having an opportunity to avail themselves of lectures which they could not otherwise have, so that the foresters, for instance, could get a general knowledge of agriculture which they would not gain in a special school.

Experience has accordingly justified this change, and the arrangement still exists.

Originally the whole instruction in agriculture was given by Schwertz, who taught general and special plant culture, cattle breeding, vine culture, book-keeping, &c. Two professors were soon appointed, one of mathematics and the other of the auxiliary natural sciences, while instruction in veterinary science was given by the medical councillor-in-chief of the government, who went over from Stuttgart once a week for the purpose. The removal of the forest school added one only to the corps of instruction, but on the acquisition, in 1822, of the domain at Hohenheim, the farming operations became still more extended, and men scientifically educated were required in each chief

branch of farming, and an instructor in sheep breeding, another in agricultural technology, and another in the culture and management of fruit-trees, were appointed, from time to time, as the exigencies required.

Pupils in the higher or agricultural institute paid, if natives of Würtemberg, $164 for tuition, lodging and board, or if from abroad, $205; and all ate at a general table. But in 1825 it was thought more convenient to separate the cost of board from the other charges, and the price of tuition and room was fixed at $41 for natives and $123 for strangers. All were required to room in the building till 1842, since which time the pupils have had the liberty to board out of the institute if they choose.

It will be seen that the agricultural institute is founded upon a large and liberal basis, and everything that strikes the eye would lead one to think that it is the chief and most important object; yet, important as it is, it is probable that the practical results of the School of Practical Farming, the *Ackerbauschule*, are quite as valuable as those of the institute, which makes greater pretensions and enjoys greater facilities for instruction in the higher sciences.

This school of Practical Farming was begun at the close of 1818, with ten stout boys of 14 years of age from the orphans in Stuttgart and other cities. These boys had but one instructor, who had to keep them at work and train them to the greatest possible activity, order, and good conduct. They received to some extent the theoretical instruction of the students in the higher institute, but in 1824 they began to have more or less theoretical instruction adapted to the capacity of each, and to their future designs.

This practical school was modified in 1829, when the number was extended to 25, and instead of taking orphans as heretofore, the sons of peasants especially, were to be admitted, between the ages of 16 and 18, who, as they were already familiar with the ordinary routine of farm work, could be immediately useful on the farm and taught the improved processes of agriculture in a shorter time.

They are required to spend three years at Hohenheim, and must be natives of Würtemberg. Their instruction in the theory of agriculture is limited to two hours a day.

The arrangement with regard to orphans was kept up, the number being limited to twenty-five, who were required to spend two years at Hohenheim, in order to get sufficient agricultural knowledge to be capable of becoming teachers in schools for the advancement of agriculture in their own districts, but this arrangement was given up in 1828 on account of the cost.

Special Courses.—A school of gardening was established in 1844 at the same place, but still independent of the others. Six pupils only were admitted into this, and each must have attained the age of seventeen years. Each applicant must have spent three years as gardener or vintager, or attended the course at a farm school, and the garden school aimed in one course to perfect what had previously been begun in the art of gardening and fruit culture. Then, in addition, there were established at the same place, special courses for orchardists, meadow husbandry, shepherds and school teachers.

The course for orchardists, which has been continued since 1850, was designed for young men of 18 years and upward who wished to prepare themselves for managers of the fruit trees belonging to the communes or parishes, of which there are immense numbers everywhere around the villages and highways of the kingdom. This course lasts from four to five weeks in the spring of each year, and a few days later in summer for practice in grafting. On account of the crowd of applicants to this course, in the last few years, from all parts of the kingdom, it became necessary to extend it to three courses a year, with from fifteen to twenty pupils in each, so that now this theoretic and practical instruction in fruit culture continues from the middle of March to the end of May, and a continuation of the course occurs also in August.

The five weeks' course upon the technical management of meadows, has been continued regularly in the spring since 1855, whenever there has been a sufficient number of applicants. It includes the art of treating meadows, field drainage, the establishment of boundaries or practice in applied geometry, for those who wish to perfect themselves in farm engineering. The number of attendants on this course has averaged 8.

The course of instruction for shepherds was opened for the first time in 1855, and has continued uninterruptedly since with

an average of 10 to 12 attendants. Applicants are required to be over 20 years old and to have been in practice with shepherds four years. The course takes place in February and lasts four weeks.

To these courses was added another in 1860, for school teachers, which is limited to three weeks in the autumn vacations of the public schools. The principal object is to provide the means of a continuation of their agricultural education, which was found to be needed in many parts of the country. Such teachers only are invited to attend this course as have busied themselves on their own or on the school grounds, with agricultural labors, in the formation of means for improvement in agricultural education. The instruction embraces the whole of agricultural labor, with special researches into the imperfections and failings which appear in different parts of the country. The number who may attend each course is fixed at 25.

Instruction in these several courses is given partly by the regular corps of professors of the institute, and partly by persons from abroad who make a specialty of certain pursuits, who go to Hohenheim for the purpose, and the arrangement is such that the pupils during their stay in Hohenheim are occupied the whole of each day, partly in hearing lectures, and partly in demonstrations in the field, in the stalls, in the collections, or in excursions, and partly in the solution of prescribed tasks.

These may be called regularly established courses of special instruction. But in addition, what may be called extraordinary or occasional courses, are also given, as, for instance, in 1853, a course upon silk culture, another on bee culture and on the nursery business. They took place in the afternoon of each Wednesday, from four to six, and were attended by twenty young men, mostly sub-teachers or assistants in the schools. In 1855, another course was given upon silk culture, designed for the pupils of the normal schools, of whom one hundred and thirty-four attended. A similar course of agricultural instruction was given in 1861 for the school teachers in the jurisdiction of Stuttgart, in which fifty-two teachers of the public schools engaged. The lectures were accompanied by demonstrations in the field, and in the collections, an afternoon of each week, and the design was to prepare the teachers for holding evening agricultural schools in winter. And so in 1852–3, on the occa-

sion of considerable changes in the laws regarding distilled liquors, two courses of instruction were given to the revenue officers upon the processes of distilling. One lasted ten days and the other twelve, and was attended by over sixty officers of the revenue who desired the information. And so, also, a vast amount of labor is done and information imparted in answer to letters and through numerous publications by the professors, all of which widen the circle of influence of the institution.

The means of instruction in the institute proper were limited, as already stated, at the foundation, to a physical and mathematical apparatus, an outfit for the chemical laboratory and a little natural history collection, for which the queen had contributed a thousand florins, and this was confined strictly to agriculture. Still with the small number of pupils it was made the means of important instruction in special branches. As for the farm a greatly improved arrangement of lands was adopted than that common in the neighborhood, either then or at present. Schwertz, who was born at Coblentz in 1759, and who was familiar with the agriculture of Belgium, where it was carried on in the highest perfection then known, not only got many improved implements but also a skilful foreman who was acquainted with their use and could teach it to others.

An implement manufactory formed a part of the design, one that should not only supply the wants of the farm with the best tools, but be the means of introducing the most improved implements into the country, and the institute was extremely fortunate in getting the right man for the place, one who had been with Fellenberg at Hofwyl, as an implement maker, and who not only answered expectations, but soon won a high reputation for the implement branch of the establishment by the strength and goodness of the work.

In 1852, and each year since, arrangements were made for the purpose of securing a more rapid and general spread of improved agricultural implements throughout the country whereby master wheelwrights and smiths were provided with an opportunity by a stay of some six or ten days in the implement manufactory at Hohenheim, of becoming familiar by observation, handling, drawings, models, &c., with the course of business and the manner of manufacture there, and the master mechanic took it upon himself to give the requisite

explanations. Up to this time no less than seventy-seven master smiths and fifty-eight master wheelwrights have availed themselves of this opportunity to perfect themselves in their business.

But as imperfect and defective as were the arrangements at the outset, at Hohenheim, there was one thing that neither the director nor the pupils were in want of, and that was an earnest love for their work and an enthusiasm for the high reputation of the new institute. It was not the least of the merits of Schwertz that he knew how to infuse such an enthusiasm into all his pupils. Where such a spirit reigns great things are easily developed from small. Forty-five years have now passed away and from the weak seed then planted a strong fruit-bearing tree has developed its wide-extended branches. From eight pupils of 1818, the number has increased to one hundred and fifty in 1863; and from one great professor the number has grown to twelve.

Such is a brief sketch of the earlier history of the institute at Hohenheim. Let us look for a moment to its present position and prospects.

The domain consists of about 825 acres, not including a vast forest of over 5,000 acres, belonging to the government. The government exercises a controlling influence in the general management of the institute, and the reports and financial standing of the establishment are made to the proper authorities at Stuttgart. But at Hohenheim, the institute, as well as the farm with all its branches and dependencies, is under the immediate control of the director, who has an assistant, or secretary, also a farm assistant, who acts also as a tutor in the institute. There is also a treasurer and a book-keeper, a librarian, who assists in the office, an overseer in the institute, a house-master and a post-master. The director, at present von Walz, is also head teacher of agriculture, and lectures upon agricultural practice, taxation of property, special plant culture and agricultural architecture.

There are nine established professors, as follows:—

Dr. Riecke, professor of mathematics and physics.

Karl Siemens, professor of agricultural technology and head director of the implement manufactory.

Dr. Fleischer, professor of geognosy and botany, and director of the botanic garden.

Dr. Nördlinger, principal teacher of forestry, and steward of the hunting grounds at Hohenheim.

Dr. Emil Wolff, professor of chemistry, and director of the agricultural chemical laboratory.

Dr. Rau, professor of agriculture, who lectures upon agriculture in general, plant culture, meadow management, vine, hop and tobacco culture, breeding of cattle, sheep and smaller animals.

Dr. Rueff, professor of veterinary science, who lectures upon zoölogy, horse-breeding and silk culture.

Professor Fischbach, second teacher of forestry and steward of the forests at Denkendorf.

Besides these, there is a teacher of book-keeping, another of national economy and the laws of forests, a director of the garden school, who teaches fruit and root culture, and a head teacher, Mr. Kik, manager of the farm school, who gives instruction in bee culture. The farm inspector also conducts some agricultural exercises on the experimental field.

These professors are appointed by the king, upon presentation to the minister of the interior, made by the general council of agriculture.

The salary of the professors, like the pay of scientific and literary men generally in Germany, is very small, scarcely adequate to their support, even on a very economical establishment. This accounts for their prolific pens. They are compelled in very many, no doubt in the vast majority of cases, to write books, prepare articles for the scientific journals, and otherwise to eke out the means of a respectable support. The cost of living is, in some sections, a little less than with us, to be sure, but to live equally well, the difference is but small, so far as I could judge from the cost of very many articles which I could compare.

The salary of the director amounts to 2,500 florins, $1,025. That of three professors, each 1,500 florins, $615. One professor has but $533. Three others have $492 each. Another, $348. Two assistant teachers, each $102. As the professors and their families room in the buildings of the chateau, which

are amply sufficient for the accommodation of all, and many more, I do not suppose they are charged with rent.

The students of the higher institute are admitted, after the age of eighteen, without examination, on certificate of willingness on the part of parents and of industry and good conduct at the schools hitherto attended, and at any time during the year, and are held to no very rigid discipline, being required to attend three of the regular courses every week, which they may select. They rise and go to bed when they choose, and employ their time as they choose, and go out from the institute with an examination. Many sons of wealthy families are no doubt attracted there by the beauty of the institution for an agreeable temporary residence. They have as complete control of their time and their actions, within the reasonable limits of good conduct of course, as the students at our law, medical and divinity schools. It may not be generally known that all students in German universities are left or thrown upon their own responsibility to a far greater extent than the students of any of our colleges. Their whole early education familiarizes them with this liberty, and it is not probably so liable to abuse as it would be with us. But it is no less true that real severe study requires the stimulus of emulation, and necessity or compulsion, especially upon minds not arrived at full maturity.

The lectures begin at six o'clock in the morning in summer and at seven o'clock in the winter, and end at seven o'clock in the evening throughout the year. They continue with only two hours' intermission for dinner at noon. Two lectures, for different sections, are often going on at the same time. It may be proper to remark that there is a sort of impassable aristocratic barrier between the institute pupils and those of the school of practical agriculture. The instructors of the institute alone bear the title of professors, a dignity rather inaccessible to the tutors and teachers in the lower or school of practice, although these latter often give courses before the students of the institute. This barrier falls, no doubt, when they separate at the close of the course and go out to take their places in society, according to the capacities of each. I am inclined to think it is a fact that the graduates of the lower school are more successful in securing places as stewards and managers of estates than those of the institute, many of whom have to rely on such positions.

Since the establishment of the institute it has sent out no less than 2,944, including those in the school of forestry, or 2,322 agriculturists, and 622 foresters; while from the school of practice, since its opening, in 1818, to 1861, inclusive, the number of graduates is 334, without including some temporary students, a few of whom are taken nearly every year.

The Other Means of Instruction.—Among the means of instruction presented at the institute may be mentioned, what has already been alluded to, the whole management of the farm, with its experimental fields, the implement manufactory, the workshops, the forests and hunting parks, the nurseries, both native and exotic trees, the botanic garden, the library and the different collections and apparatus designed especially for the purposes of instruction.

The botanic garden was started in 1829, with an area of about ten acres. It was intended to serve the double purpose of instruction and ornament to the surroundings of the chateau. I spent a good deal of time in the various parts of this garden. It is laid out on a generous scale, with an agreeable, park-like aspect; groups of trees, ornamental and useful shrubs, parterres of flowers and lawns well kept. A part of it is devoted to annuals, where an immense number of varieties of wheat and other grains are cultivated; each plot labelled, so that the visitor may know, without a guide, what each contains. In another part are the perennials, especially those of economical value. A grass garden forms a part by itself, where the different species of grass are cultivated in little clumps, each labelled with its systematic and common name; while an arboretum of considerable extent is, at all times, accessible for students and others.

The library contains 4,000 volumes on agriculture and forestry and their auxiliary sciences.

The collections are very extensive and valuable, more so than at any other institute of the kind that I visited. They consist of large collections of soils, manures, models of implements, and implements in full size; admirable collections of wools, kept in glass cases, among which are complete historical collections from the sheep kept on the farm for many years back, especially of the most celebrated bucks and ewes; collections of woods, minerals, petrifactions, &c.; collections of seeds of fruits, her-

bariums, pathological and zoölogical collections, apparatus used in the lectures on physics, the chemical laboratory, &c.

The course of instruction in the institute embraces a very wide range, and a full detail would lead too far. A general outline may be stated, as follows:—

1. General field and plant culture. This includes a general introduction, the objects of cultivation and the connection of cattle breeding with farm operations; also instruction upon climates, soils, manures, implements, working the soil, multiplication of plants, care of seeds, crops, preservation of farm products, accompanied by demonstrations in the field, the collections of models and machine shops.
2. Special plant culture.
3. Meadow cultivation.
4. Wine, hop and tobacco culture.
5. Fruit culture.
6. Vegetable cultivation.
7. Breeding of general farm stock—embracing domestic cattle and their necessity for man, science of feeding and nourishment, care, uses, multiplication, choice, &c.
8. Horse breeding, including the structure and anatomy of the horse; with the assistance of a large collection of fine illustrations of the different breeds, and excursions made to the various royal studs in the kingdom.
9. Cattle breeding—with demonstrations in the stalls, collections of models and cheese dairy.
10. Sheep breeding, including instruction in regard to wools, demonstrations in the sheep stalls, in the wool and model collections, and in the wool market at Kirchheimer.
11. Swine and poultry breeding, accompanied, also, by practical demonstrations in the pig-sties and collections.
12. Silk culture—including the care and cultivation of mulberries, the proper buildings, the treatment of silk-worms, &c.
13. Bee culture.
14. Practical agricultural instruction—embracing, in general, the duties of steward, landed property in its political and legal relations, position, climate, soil, farm buildings, &c.; capital, labor and, particularly, the organization and direction of a farm; choice of objects, estimation of requirements of manure, statics, nourishment of plants, choice of stock, rotation, farm system,

division of fields, transition from one course of cropping to another, &c.

15. Taxation of farm property.

16. Farm book-keeping.

17. Agricultural technology. This course embraces a year's instruction upon the manufacture of beet sugar, beer brewing and the distillery of brandy in the winter term, and the manufacture of vinegar, starch, the grinding of meal, tile and brick making, and wine and cider making in the summer term, with the innumerable details connected with each.

The auxiliary branches include—

(1st.) Arithmetic and algebra.

(2d.) Theoretical geometry.

(3d.) Trigonometry.

(4th.) Practical geometry, which includes surveying, land measuring and levelling.

(5th.) Estimation of the value of forest lands, beginning with the cubic contents of timber, the growth of single trees, whole forests, &c.

(6th.) Mechanics and physics.

(7th.) Chemistry, in the winter term, general, in the summer, agricultural chemistry, with practice and experiments in the laboratory. The lectures on agricultural chemistry treat, among other things, upon the composition of feeding substances, the theory of feeding, &c.

(8th.) Introduction to geology, the object being to give the student a full knowledge of all those minerals alluded to in the lectures on special geognosy, and which are of more or less importance as elements in the soil, and in organic bodies.

(9th.) Geognosy, science of minerals, composition, adhesion, hardness of rocks, their contents of water, air, warmth, &c. Structure of masses of rocks, groups, systems, &c.

(10th.) Introduction to botany and special economic botany, in connection with which weekly excursions are made during the summer, in the neighborhood of Hohenheim, in addition to which are demonstrations in the botanic garden and the collections.

(11th.) Physiology, anatomy and pathology of plants—their anatomical composition; elementary organs—the different forms of cells; the compound organs, the structure of the root, the

stem, the leaves; microscopic demonstrations—life of plants in general, assimilation, secretion; chemical composition of plants—the elements, organic and inorganic; the external conditions of plant life—influence of heat, light and electricity on plants, &c.; internal conditions of life. A pathological collection and a good microscope are constantly used in the demonstrations.

(12th.) General zoölogy, with explanations by skeletons.

(13th.) Special zoölogy, with constant use of the zoölogical collections, in classes, families, breeds, &c.

(14th.) Veterinary science, including the structure of domestic animals, with practical demonstrations.

(15th.) National economy.

(16th.) Laws relating to forests.

(17th.) Agricultural mechanics—building materials, foundations, structures, &c.

(18th.) Drawing of plants.

These courses are so arranged that the pupil can go over their whole range in two terms, or one year, if he has had sufficient preparation at the outset; but generally it requires the regular course of two years of the institute.

The course of instruction begins on the first of October, and the first, or winter term, continues till the tenth of March, when there are three weeks' vacation, after which follows the summer term till the first of September. An examination takes place at the end of each year before the royal commission, when prizes are distributed to such as have distinguished themselves by industry, good conduct and acquirements.

To show how the day is occupied, the following PLAN OF STUDIES is posted about the rooms.

Arrangement of Lectures for the Summer Term, 1863.

HOURS.	Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.
6 to 7, .		Horse breeding.	General Zoology. Laws of Forests.	Veterinary Science. Laws of Forests.	General Zoology. Laws of Forests.	Veterinary Science. Laws of Forests.
7 to 8, .	Analytical Chemistry. Stereometry.	Wine, Hop & Tobacco Culture. Valuation of Forests.	Wine, Hop & Tobacco Culture. Valuation of Forests.	Agricultural Chemistry. Stereometry.	Technology. Valuation of Forests.	Technology. Special Zoology for Foresters.
8 to 9, .	Architecture. Forest Practice.	Architecture. Protection of Forests.	Agricultural Taxation.	Special Plant Culture. Protection of Forests.	Special Plant Culture. Protection of Forests.	Cattle Breeding. Special Zoology for Foresters.
9 to 10, .	Practical Geometry.	Agricultural Chemistry. Trigonometry.	Agricultural Chemistry. Trigonometry.	Practical Geometry.	Practical Geometry.	Technology.
10 to 11, .	Forest Taxation.	Cattle Breeding. Forest Taxation.	Cattle Breeding. Forest Taxation.	Sheep Breeding. Forest Taxation.	Sheep Breeding. Forest Management. Forest Taxation.	Sheep Breeding. Forest Management.
11 to 12, .	Agricultural Chemistry.	Botany.	Botany.	Botany. Law.	Botany. Law.	Law.

2 to 3, . .		Forest Excursions and Reviews of Lectures.	Agricultural Demonstrations. Forest Botany.		Silk Culture.	Silk Culture.	Agricultural Demonstrations. Forest Botany.	Demonstrations in Fruit Culture.	Forest Excursions and Reviews.
3 to 4, . .			Geognosy.		Geognosy.	Geognosy.	Geognosy.		
4 to 5, . .			Practice in Agricultural Taxation.	Drawing of Plants.	Botanical and Geognostical Excursions.	Field Measuring.	Vegetable Culture.	Farm Practice.	
5 to 6, . .	Vegetable Culture.						Agricultural Demonstrations.		
6 to 7, . . .			Horse Breeding.						

Work in the Chemical Laboratory in the afternoon of Mondays, Tuesdays and Thursdays.
Special hours assigned for Bee Culture.
Library is open Tuesdays and Fridays from 1 to 2 o'clock.

The Cattle.—It was thought that no race of cattle, that did not unite the different good qualities in the highest degree, would be adapted to the wants of Hohenheim; and no race prominent for one quality, as for instance, for milk, the yoke, or beef, would answer the necessity. After a fair trial of the Dutch, the English, the black and white Bernese, the Swytzer, the Montafoner, the Allgäuers, the Hungarians, the Triesdorfer, the Ansbacher, the Haller and the Limbourger, it was found that the qualities most desired, were united in the greatest degree of perfection in the Simmenthalers. Since their first introduction, in 1835, they have constantly increased; and now the whole herd, except one, of from 80 to 100 head, are either pure, or nearly pure bred Simmenthalers. The Allgäuers are admitted to be better for milk; but, taking color and all other characteristics into consideration, the Simmenthalers carried the day. No experiments are now made to test the comparative merits of different breeds, either at Hohenheim, or at any other agricultural school that I visited in Europe.

These cattle are all uniform in color, of a yellowish or tawny brown, approaching to red. They have mostly been raised on the farm, from fourteen cows and two bulls, which were selected in the Canton of Berne, in Switzerland, in 1835; and a second purchase of sixteen cows and two bulls, in 1838; and a third, of seventeen cows in 1844. The horn is short, the skin yellow, soft and mellow to the touch, mostly good handlers; the barrel large, the quarters well developed, back straight, chest full and well formed. The head is somewhat inclined to be coarse in many of them, as well as the dewlap; while the shoulders and neck also of the bulls are too large and coarse. The males are inferior to the females in the form and structure of the fore-quarters, head, neck and shoulders. They weigh from 1,200 to 1,350 pounds, some considerably exceeding that. Prof. Rau informed me that they would average about 1,300; but the whole stock is weighed every year, and the average weight depends a little upon the condition of the cows at the time of the weighing, the number in calf, the quality of their feed at the time, and other circumstances. In 1847, for instance, 78 weighed 69,607 pounds. In the spring of 1859, 104 head weighed 88,920 pounds, an increase of 19,213 pounds. The general average of all the weighings, between 1846 and 1862,

gave 1,240 pounds; but the weight has no doubt been increased by the good keeping at Hohenheim, and exceeds that of the animal on its native mountain pastures. The bulls often weigh as high as 1,800 to 2,000 pounds.

All the cattle, except, of course, the working oxen, are kept in stall the year round. The stall is roomy, high, light and dry,—263 feet long—with a roof of sloping boards. The standing-platform is stone, cemented, with channels behind for carrying off the drainage. The cows stand in two rows, head to head, and between, through the whole length, there is an elevated passage-way, ten feet wide, for feeding, with troughs made of oak plank. No fodder racks are used. The stable is about forty feet wide. The windows are large, with iron frames, easily opened and shut. The doors are also arranged with slides, to secure ventilation. Just outside are sheds for cutting the green fodder, as it is brought up—an old man and a stout peasant girl were kept at work, in cutting vetches and clover, nearly all the time I was there.

The feed is green; taken fresh from the field, from the beginning or middle of May till the end of October; consisting of rye, lucerne, clover, trefoil, vetches, sugar millet, turnip leaves, spurry, &c., alternately. All the food, green and dry, is cut up, so as to prevent any loss. The feeding value of green food to hay, is as one to five. In winter the feeding consists of hay, clover hay, or other dry fodder; beet-roots and straw; malt combs are occasionally fed. Oil-cake and crushed grain are given now and then. The feeding of raw potatoes has become impracticable, on account of the rot. The winter fodder statement shows that 100 pounds of hay are equal, in nutritive value, to 275 pounds beets, carrots and artichokes; to 200 pounds of straw, rape husks, potatoes; to 160 pounds chaff; to 125 pounds beer malt; to 60 pounds oats; to 50 pounds crushed grain and oil-cake.

The following table will serve to show the number of pounds of food of various kinds, and its equivalent in hay, which each animal is accustomed to receive per day:

STOCK.	Length of Time.	POUNDS.							
		Hay.	Straw.	Chaff.	Beets.	Malt.	Oil-Cake.	Value in Hay.	Straw for litter.
44 cows, . .	1st to 17th Nov., . .	15	4	4	35	–	1¼	=35.22	6
2 bulls, . . .	18th Nov. to 1st Dec.,	8	2	7	45	4	2	=36.93	6
39 cows, 2 bulls, .	2d Dec. to 4th May, .	8	4	5	45	4	2	=36.68	6
37 heifers, . .	1st to 10th Nov., .	16	–	–	–	–	–	=16.00	–
34 heifers, . .	11th to 17th Nov., .	9	6	–	15	–	–	=17.45	5
34 heifers, . .	18th Nov. to 1st May,	8	3	–	24	–	–	=18.22	5
10 calves,* . .	1st to 10th Nov., . .	12	–	–	–	–	–	=18.00	4
8 calves,* . .	11th Nov. to 27th July,	12	–	–	–	–	–	=18.00	4

* Three pounds Crushed Grain.

From this it will be seen that for the older stock about 36 lbs. of hay or its equivalent are required per day. It has been found that a sixtieth or $1\frac{2}{3}$ per cent. of live weight will support the animal without loss, but also without gain, and to provide for secretions, as milk in cows, wool on sheep, it is necessary to double that ration, making it a thirtieth of the live weight or $3\frac{1}{3}$ per cent. This is greater than would be required if the cattle had been raised and kept up in condition from birth, as is the case in England, which is no doubt the most economical method. The roots are cut. The oil-cake was formerly softened with water before feeding out, but now, like the crushed grain, fed out dry with a slight mixture of salt, of which 12 lbs. a year on an average, are used per head. The feeding takes place twice a day, morning and evening. Each meal is divided into several small parts, and a new one given only when the last is eaten up. The stock is watered at a fountain outside, between the regular meals. The fountain is a little way off from the stable, so that they get some exercise in going and coming. The young stock is turned daily into a roomy yard close by the stalls. All the stock is curried every day, and kept clean and neat.

It has been found by careful observation that an animal attains its greatest weight of body and greatest yield of milk at 8 years; i. e., after the sixth calf. A cow just before calving weighs 150 lbs. more, on an average, than after calving, and about 200 lbs. more than when dry. The calves usually weigh 80 lbs. and 88 lbs. according to sex. The weight of a calf when dropped is from $\frac{1}{15}$ to $\frac{1}{16}$ of the average weight of the

cow. The use of males for breeding is commenced at a year and a half old, but they are not much used till two. In 100 calves 94½ per cent. are living and 5½ per cent. dead. Among 100 calves, $55\frac{2}{10}$ per cent. are males, and $44\frac{8}{10}$ per cent. females. In 100 parturitions, $4\frac{2}{10}$ per cent. are twins.

A form of cattle register is kept as follows:—

Name and Breed.	Sire.	Dam.	Day of Birth.	Copulation.		Weight.		Remarks.
				Day.	Bull.	Day.	Pounds.	

The form of pedigree register is as follows:—

No., Name, Date of Birth, Description.	Breed.		Copulation.		Remarks on the Calf.					Weight of Cows.		Yield of Milk.			General Remarks.
	Sire.	Dam.	Day.	Sire.	Day of Birth.	Race.	Weight.	Quality.	Later Remarks.	Day of Weighing.	Pounds.	Year.	Pounds of Milk.	No. of Days in Milk.	

An account is kept so that the weight of milk of each cow and each month is seen at a glance, the yield of each noted and the yearly yield noted. The average annual yield per cow is 4,816 pounds. It occurs as follows:—

After the 1st calf,	3,616 lbs.	After the 4th calf,	4,852 lbs.
" 2d "	4,492 "	" 5th "	5,308 "
" 3d "	5,048 "	" 6th "	5,352 "

After that the yield continues the same for some time, or falls off. It does not increase. The largest yield of any one cow bred at Hohenheim was from a cow which I saw when there. Her weight was about 1,200 pounds. She gave in one year nine thousand six hundred and seventy pounds, in the year after her fifth calf, at the age of eight. The general average yield of milk is four times the live weight of the cow each year.

The milking takes place twice a day at the time of the morning and evening feeding. The average time of going dry is three months; the number of milk days, 275. The milk is sold to a dairyman and cheese-maker.

Young stock, not wanted on the farm, is sold at public auction twice a year, in May and October. The average price for bulls from a year to a year and a half old, is $58.47. The highest price for any one animal was $172.20.

The raising of calves is artificial from birth. They are taken from the dam and fed from the pail. They do exceedingly well; the cow is less disquieted and the trouble is less than if the calves suckle the cow. The latter is allowed some days with young cows after the first calf till they get used to being milked. The amount of food given is:—

1st week, daily,	12	pounds of milk,	–	pounds of oatmeal,	–	pounds of fine hay.
2d " "	16	"	–	"	–	"
3d " "	20	"	–	"	–	"
4th " "	22	"	–	"	–	"
5th to 7th "	22	"	½	"	½	"
8th week, "	24	"	½	"	½	"
9th " "	20	"	1	"	1	"
10th " "	16	"	2	"	3	"
11th " "	12	"	2	"	6	"
12th " "	8	"	2	"	10	"
13th " "	4	"	3	"	10	"

In the ninth week the milk is first mixed with water and a little fine oatmeal. The meal is after that mixed with the dry fodder. After three months the milk is withheld, and then the young animals receive daily, till two and a half years old, from twenty to twenty-two pounds of hay, or its equivalent. But the calves never after receive, even in summer, any but dry food, till they are nine months old. The average feeding is so divided that the younger portion receive less, the older more, till two and a half years, when they begin to receive the regular rations of the older cattle, including the grain fodder as indicated above. The growth with this treatment is so remarkable that it is only a little surpassed by the rapidly maturing Shorthorns.

The average weight of heifer calves at			3	months	is	233	lbs.	Bulls, 353 lbs.
"	"	"	6	"		357	"	" 472 "
"	"	"	1	year		640	"	" 750 "
"	"	"	2	"	"	1,180	"	" 1,300 "

The daily increase of a heifer calf is 1.5 lbs. Of a bull calf, 1.8 lbs.
" " " in the 2d year is 1.4. Of a bull, 1.5 lbs.

Few animals are fattened except working oxen, and now and then a cow that goes dry. At the commencement of winter, when the work is over, about twelve oxen are usually fed for beef. The process never exceeds four months. The oxen receive daily, 10 lbs. of hay, 6 lbs. of straw, 25 lbs. of beets, 45 lbs. of beer-malt, 4 lbs. of oil-cake; in all 66 lbs. of hay or its equivalent, and 6 lbs. of straw for litter, a day. The average time of feeding for the last four years was one hundred and twenty-three and a half days. The increase per head in this time was three hundred and two and three-quarters pounds, or two and one-half pounds a day on an average, live weight. For each one hundred pounds of hay, or its equivalent, fed out, the animal took on 3.64 pounds live weight.

From what has been said it will be seen that all the feed of stock, the dry and green forage, straw, &c., is cut, mixed or macerated. This is the case, with very few exceptions, all over Germany.

The Sheep.—Hohenheim undertook to improve the sheep of the country by breeding and furnishing suitable bucks. The object was a breed tolerably rich in wool and size of body, hardihood and capacity for supporting themselves on mountain pastures in summer, and dry pastures and the sheepfolds in winter. These qualities it was difficult to find in any known breed, and to get one was the problem to be solved. Very fine woolled sheep, and sheep eminently adapted to mutton, were the exceptions, and did not sufficiently unite all these qualities. The characteristic sheep of the country is a wool-mutton sheep, got from a cross of the Merino with the German sheep with a live weight of 90 to 100 lbs, and a clip of 3 lbs. of No. 2 to No. 4 wool, which had the character partly of a cloth and partly of a combing wool.

The fat bucks of this so-called grade sheep, which exhibited different degrees of improvement, yet having attained such similarity and fixedness of type as to be designated abroad as

the Würtemberg race, have created considerable demand in trade, especially for France. The demand for mutton sheep, in the last few years, and the keeping of sheep for their manure, has greatly increased, while the demand for extremely fine cloth wool and carding wools has fallen off, partly on account of fashion and of the wool manufactures, partly on account of a want of docility and endurance of folding of such sheep. The Electoral flocks have become less and less, their places being supplied by coarser and heavier fleeced animals. The result of this change has been the increased importance of mutton producing sheep, and the production of a cross breed in Hohenheim with the older Merino basis, in the years 1854 and 1855, and since. 45 native ewes in lamb by a fine buck were bought and 24 English Merino ewes put with them, which came from a cross of an English buck with long wool and large Merino ewes in 1830. This new breed has now grown up to 200 ewes. The principal bucks used besides that named, were one from Rambouillet, and a third of Rambouillet and English cross-breed.

Besides this English Merino breed, which was kept up from 1822 to 1850, is the so-called Justinger breed. The Duke of Würtemberg effected a purchase in Segovia (Spain) and in the south of France, in 1786, which was bred as the State model flock on the estate at Justinger. In 1822, ten hundred and eighteen of them were transferred to Hohenheim. In 1829 the institute lost the Justinger pastures, and had to stall-feed the flock in summer. The Justingers had a middling fine wool fit for cloths, and were large and sheared heavy fleeces. They improved the flocks of the country. The 45 ewes above-mentioned had come from them. But not only the new breed, but the old Hohenheim Merino flocks contained Justinger blood. In transferring the State breeding flocks to Hohenheim, a flock of the purest Electorals from the Saxon folds, consisting of 83 ewes and 7 bucks, was kept till 1826. They formed the fine Hohenheim Electoral, which was improved by two bucks and four ewes from Upper Silesia in 1846, and had grown up in 1850 to 130 breeding ewes.

The Electoral bucks have been used to improve the Justinger ewes since 1824, and thence are called the Justinger-Electorals. As a result of the cross, the wool became so fine that in 1850 the Justingers and Electorals could be put together. The

number of Electoral ewes was thereby increased to 224 head in 1851, while on account of the heavy sale of wool they were reduced to 50 head in 1862.

Another part of the Justinger breed, selected from rich and long-woolled animals, was used for the formation of a fine comb-wool breed and was bred on pure by itself from 1830 to 1841. A comb-wool buck from the flock of Count Schwerin, with long, slender, glossy wool, was bought in 1843—whence the present comb-wool flock of 200 ewes proceeded. They intend to reduce this flock also, on account of the slow sale of the wool.

A third part of the Justingers, from long-woolled animals, was crossed with the long-woolled and mutton English Leicester bucks. From that cross came what they call the English Merinos, in 1830. In the beginning they used pure English bucks, and in 1842, pure Leicesters. The yield of wool not being satisfactory, they put the ewes in 1847 and 1848 to comb-wool bucks. In 1854, this flock, which never much exceeded 20 ewes, distinguished by its broad build, was mixed with the newly-founded cross-breed, as already mentioned. The principles of breeding adopted in the management of this flock had in view the weight of fleece, and weight of body first, with the Electorals fine wool, with the comb-wool breed quantity with softness or pliancy, and strength and gloss. All three flocks are folded, and were put together on the 1st of August, 1862.

	Ewes & Yearlings.	Ewe lambs of 1862.	Old bucks.	Buck lambs of 1862.	Wethers.	Totals.
1. Electorals, ...	68	12	4	11	1	96
2. Comb Wools, . . .	294	63	19	73	60	509
3. Grades, ...	240	64	42	70	28	444
Totals, ...	602	139	65	154	89	1,049

The lambs are all numbered by notches and holes in the ears, a few days after they are dropped. A register is kept. Males are used for breeding at a year and a half old, females, at two and a half. A buck usually serves not over 50 and is never allowed over 75 ewes.

Winter lambing was continued from 1822 to 1848. Summer lambing was tried in 1838 with a part of the flock, in order to get a greater yield of wool, the lambs coming in June and July. Now, since 1848, they all come in May and the first half of June. They get, on an average, 69 lambs to 100 ewes. One hundred Saxonies had 63, one hundred comb-wools had 75, one hundred Justingers had 67, one hundred English Merinos had 72, one hundred Grades had 101 lambs. In summer lambing it was found that buck lambs predominated, while in winter and spring lambing the ewe lambs were more numerous. A pair of twin lambs occurs on an average with Grade sheep, in every nine births; with English Merinos one in every 24, with comb-wool sheep one in every 26, Justingers one in every 49, Electorals one in every 60. The average of all is twin lambs in 31 births.

It would appear from this that the farther we go from the highest type of fine wool the more prolific the sheep become. The Holstein sheep, at the international fair, a long-woolled breed from the marshes, had, in some cases, five lambs; in others, four; in others, three; eighteen lambs were dropped and nourished by five dams.

The twins are most frequently of different sexes, but occasionally of the same, and when of the same, two males quite as often as two females. As the lambing time approaches, the ewes are separated from the rest of the flock by hurdles, and kept apart some days after. At four weeks old the lambs are separated part of the time from the ewes, some hours at first, then gradually for a longer time, until they are allowed together only at mid-day and at night. Castration and cutting the tails take place from three to four weeks of age. At four months old they are weaned entirely and put upon separate pastures. The sheds are so arranged that the different sexes and classes by age can be kept apart. The sheds are roomy, dry, and quite healthy.

The feed in summer is partly on natural pastures, that is, those where the natural grasses grow, and partly on artificial ones, that is, on clover stubble. The pasturage lasts from the fifteenth of April to the fifteenth of November, frequently to the middle of December, or from seven to eight months. The sheep are driven out in the morning as soon as the dew is dried

off. At mid-day they are driven under cover some hours; if the weather is hot or bad they lie in the sheds as they do by night, after the afternoon and evening pasturing. The flocks feeding in the neighborhood of the buildings are driven into the stalls; those on more distant pastures into sheep-houses.

The winter feeding lasts from the twentieth of November, on an average, to the fifteenth of April. It consists of hay and straw, roots and shorts. Bucks receive in addition some oats when put to service. The orts of the fodder straw are used for bedding. The distribution of the winter feed is as follows:—

217 Electoral ewes and comb-wool sheep receive daily, from the 2d of December to the 13th of April—133 days—$1\frac{1}{2}$ pounds of hay, $\frac{3}{4}$ pound of straw, $1\frac{1}{4}$ pounds of roots, $\frac{1}{4}$ pound of coarse ground grain. In all 2.82 pounds of hay or its equivalent. 70 yearling ewes get the same feeding from December 2d to April 6th, or 126 days. 168 lambs of the same breed get from December 2d to April 6th, $1\frac{1}{2}$ pounds of hay, 1 pound of straw, $\frac{1}{6}$ pound of coarse ground grain, equal to $2\frac{1}{2}$ pounds of hay. 16 bucks of these breeds get in the same time $2\frac{1}{2}$ pounds of hay, $\frac{3}{4}$ pound of straw, $1\frac{1}{4}$ pounds of roots, $\frac{1}{2}$ pound coarse crushed grain, or 4.32 pounds of hay or its equivalent. 140 cross-bred ewes, from the 2d December to the 13th April, get 2 pounds hay, $\frac{3}{4}$ pound straw, $1\frac{1}{4}$ pounds roots, $1\frac{1}{4}$ pounds grain, or 3.32 pounds hay or its equivalent. 52 yearling ewes, from 2d December to 6th April, get $2\frac{1}{2}$ pounds hay, $\frac{3}{4}$ pound straw, $1\frac{1}{4}$ pounds roots, $\frac{1}{4}$ pound grain, equal to 3.82 pounds of hay. 113 cross-bred lambs, in the same time, get each 2 pounds hay, 1 pound straw, $\frac{1}{4}$ pound grain, equal to 3 pounds hay. 23 bucks, in the same time, get each 3 pounds hay, $\frac{3}{4}$ pound straw, $1\frac{1}{4}$ pounds roots, $\frac{1}{2}$ pound grain, equal to 4.82 pounds hay.

The arrangement is as follows: In the morning the sheep get hay, then water is let into round troughs in the stall. At 10 o'clock, cut roots: at noon, hay, then drink again. In the course of the afternoon, cut roots, and at evening, straw. Once a week they get salt at evening, after the feeding, half an ounce a head.

The health of the flocks is remarkable, diseases very rarely attacking them. The loss is frequently no more than a quarter of one per cent. a year. The sheep are washed early in June. The shearing is done by women on contract at four kreutzers

(or a trifle less than six cents,) apiece. The fleece of each sheep is accurately weighed, and the weight entered in the register. Then the fleeces are bound up singly, those of the different breeds being kept apart. On an average of eight years, the Electorals shear 2 lbs. 3½ oz. The comb-wools shear 2 lbs. 10½ oz. The grades, 3 lbs. 3¾ oz.

The live weight of bucks of the Electoral breed is 120 lbs.; of ewes, 76 lbs. Of comb-wool bucks, 135 lbs.; ewes, 84 lbs. Of grades, 160 lbs.; ewes, 91 lbs.

The oily gum in the fleeces of the three breeds is easily soluble, and the washing makes the wool beautifully white. Dust, sand and dirt cling to the fleeces of these sheep and the washing, therefore, is followed by a considerable loss of weight. An experiment made to ascertain the average loss resulted as follows:—

The Electoral sheep lost, on an average, 4 lbs. or 63 per cent. in washing on the sheep, and at the manufactory, 12.3 per cent., making in all 75.3 per cent., and leaving 24.7 per cent. of thoroughly cleansed wool. The comb-wool sheep lost 2 lbs. 13 oz., or 50 per cent. on the fleece, and at the manufactory, 12.7 per cent. In all 62.7 per cent., leaving 37.3 per cent. of clean wool. The grades lost 5 lbs. 14 oz., or 66 per cent. from washing on the fleece, and 9.5 at the mill. In all 75.5 per cent. leaving 24½ per cent. of pure wool.

The Experimental Field was designed, not only as a means of instruction for the students, but also as a means of investigation on the part of the professors. For this purpose the plots appropriated to each experiment, consist of nearly a quarter of an acre each; a size sufficient to give to each a fair and full trial in management, manuring, cost of culture, results, &c. The fact that there are ninety-six of these plots, indicates that this part of the enterprise receives its due share of attention. It also offers the means of raising a great variety of seeds, which supply the wants of the farm and form an important item in the receipts of the institute; while it secures to the farmers of the country a certain source, from which they can obtain pure seed. But the experiments on the farm are not wholly confined to this field. Among those that have been tried, the following may be mentioned:—

1. Upon the transmission of caries in grain, and the influence of washing, soaking, fermentation of the seed on the stock, as well as on the age and change of seed.

2. Observations on the sensitiveness of growing plants to frost.

3. On the effect of large, middling-sized and small seed potatoes.

4. On plucking off the blossoms of potatoes.

5. On the exhaustion of land by rape culture.

6. On the exhaustion of wheat in comparison with green plants and fallow.

7. On the culture, year after year, of beets on the same land, by constantly fresh manuring.

8. On the continued culture of artichokes, on the same land, with manuring every three years.

9. On the effect of mowing, or not mowing, the late clover stubble in autumn.

10. On the depasturing of winter barley.

11. On the manuring of meadows.

12. On manuring with Peruvian, Baker's Island and fish guanos; rape meal, bone meal, super-phosphate, Chili saltpetre, salt, gypsum, gas lime, soda, peat ashes, Liebig's patent manure, artificial manures.

13. On the effect of fresh and rotted manure, the mixture of various crops, and many others.

This field was very instructive and interesting. The crops upon it, when I was there, were in full growth, including a large number of varieties of wheat.

Management of Manure.—There are two great manure pits, one to receive the contributions from the stalls for cows and young stock, and the other those from the horses, oxen and fatting cattle. The liquid manure is received into cisterns, whence it can be pumped up and thrown upon the manure heap, or run down into the basins in the botanic garden.

The manure is carried from the stalls on wheel-barrows and added to the heap; which is carted off usually every week, so as not to ferment and lose its value. When this is impossible, owing to bad weather, or the press of other and more important work for the teams,—as during harvesting—the manure heap is sprinkled over, from time to time, with plaster of Paris. It never remains so long as four weeks in the bulk, except during

the harvest and fall seeding, and the rule is to cart it off regularly every week.

The manure, as it is carried out, is immediately spread, that it may not rot in small heaps, or be washed and unevenly distributed. If it comes directly upon the stubble field, it is ploughed under with the stubble; if upon ground already ploughed, it remains lying spread out upon the surface, till the proper time for ploughing comes. If the land is frozen, the same is done; and it lies till the land is ready for the plough. The same course is pursued even when the ground is covered with snow; the manure is spread upon the snow, so that it immediately freezes and does not rot without a covering. The whole management is designed to have the manure, when it is possible, rot in the soil, and not in heaps upon the surface. Fermentation of manure above the surface is prevented, as far as it can be, so that the gaseous products may be developed in the soil and held fast by it.

In the sheep pens the manure remains lying a longer time. Under the treading of the animals in the close space, less goes to waste than in open heaps, yet here and there where there is danger of this, gypsum is spread over the manure, and whenever a sufficient store is collected, this also is carted out.

In summer, and commencing about the 20th of April, a part of the sheep are penfolded by means of movable fences, and in rains and great heats, they are driven under sheds or into stalls, where they are furnished with litter. The finer ewes with their lambs are folded at night in the stall till weaning time, and after the rowan harvest, the ewes are let upon the inlying meadows, but the lambs are not turned upon them till the following year. The pen is the best mode of managing and applying this manure, because nothing is lost, and the urine of the animal, which in the stall mostly escapes as ammonia, is saved. They attain also with manuring by means of the penfold more than three times as much as by the stall dung which is produced by the same number of animals in the same time.

The preparation of compost is not so extensively carried on now as formerly, because the carting to and fro costs too much. The compost heap is very conveniently placed near the buildings. It is in a circular basin hollowed out four to five feet deep, to which on two opposite sides there is an entrance and

exit, with edges four or five feet high, over which all the material is thrown, in layers upon the bed of the circular heap. In the circle there is a passage-way left, where the carts are loaded in carrying away the compost. The whole is surrounded by trees, and on the side of the entrance there is a stone ash house. To this compost is added all the rubbish from the workshops, the barns, and of special crops, as the stalks of seed roots, turnips, beets, &c., hop vines, street sweepings, the contents of privies, &c., such organic matters, especially, as decay too slowly to have much value applied directly to the field, or which decay too quickly and lose too much before they are wanted, as the night soil, or substances containing the seeds of weeds. Stable manure, which is brought directly upon the fields and mowing lands, is never added to this compost heap. To these materials only so much loam is added as is necessary to hold the gaseous products of their decay, that is, the compost must never smell, and it will not, if it is all covered over with earth. More earth than is necessary to effect this object is of no use, and only makes a useless labor of hauling to and from the heap, and loading and unloading twice over. Urine is an exception, as it is sometimes brought and thrown upon the compost, when it becomes necessary to accelerate the decomposition of the materials. The heap is not forked over, as this is too expensive, and as it lays in horizontal layers of organic materials and earth, they are cut down perpendicularly as they are carted off, so that the mass becomes thoroughly mixed and uniform.

Both the cisterns for liquid manure above alluded to are from time to time let off into the basin in the botanic garden, which lies at some distance off on a lower level, and the liquid is thus distributed by means of water, over the grounds, which saves all expense of cartage. Some of the urine is carried by means of the barrel on wheels into the vegetable garden and the experimental field, for certain plants, as cabbage, tobacco, &c., and rarely upon the compost heap.

The ashes from the many stoves of the institute, amounting yearly from 150 to 200 bushels, are spread upon the meadows and the poorer spots of lucerne.

Gypsum is not much used, except to strew over the manure, with which it reaches the fields, since in a series of years but

little influence has been traced, on clover and lucerne, though previous to 1860 it had always been more or less used, and where used it neither appears in the soil nor was it observed in the greater yield of crops.

Lime ashes from the brick-kiln, all that can be had, are applied to worn-out soils with the best results, especially in connection with the manuring for rape seed. But two to three hundred bushels can be had.

The mud or settlings, in the mill pond, is very rich, and is taken out every six or seven years, amounting to 250 cart-loads. The yard where the young stock is allowed to run, at certain times, is supplied with rape-stalks, old straw and some similar substances, and the rakings from it are put upon the compost heap, and with that upon the fields.

No manures are bought for the farm, but they sometimes spend from 60 to 70 florins, or 25 to 30 dollars, a year for horn-shavings and wool-waste from the manufactories, for the trees in the nurseries.

I might give much more extended details of the foregoing and many other branches of this institute, and its management of the great estate on which it is located, but what has been said will serve to show with what degree of system and care the whole establishment is carried on, and how useful such experiments and details here might be made to the farming community. Each school, properly conducted, would become in fact a great experimental station, the results of which would serve, in a measure, to educate the whole community, as well as the students who might have the more direct advantages of it.

The number of students in the higher institute at the time I was there was 150. The ancient riding-schools, with ceilings adorned by splendid fresco paintings by some of the first artists of the last century, are now used as barns for the storage of grain.

The collection of implements at this school is, I think, the most extensive and instructive of any I saw in Europe. The collection of models is also very large and well arranged. The students in the lower school, or school of practical farming, have a lecture from 5 to 6 in the morning, then work from 7 to 11½, and from 1 to 6½ or 7. They have another lecture or study from 8 to 9 o'clock. The time devoted to study and

instruction is increased in winter and during rainy days. They are the sons of peasants well off in the world, having enough to rent or buy a farm. They enter for three years and are not admitted for a less term.

The sheep are regarded as about the most profitable branch of the farm.

This institution is practically self-supporting. It receives ten thousand florins a year from the government. That is equivalent to a little over $4,000, but I was told that with a hundred students it could pay its way.

WEIHENSTEPHAN.

The Agricultural Institute of Weihenstephan holds the first rank in Bavaria. It was modelled, apparently, after that at Hohenheim. It is situated at the little old town of Reising, some twenty miles from Munich, on what was originally, I believe, a part of the public domain of Schleissheim, the royal buildings of which domain lie within six or seven miles of Munich, and where there is still a school of practical farming similar to the *Ackerbauschule*, or peasant school, at Hohenheim.

The location of the school and farm of Weihenstephan is very fine. The immense buildings stand on a beautiful hill, overlooking a wide extent of country, and within fifteen or twenty minutes' walk from the railway station. I arrived there from Ratisbon on a bright summer morning, introduced myself to the first man I met, told him my object and learned at what hours the various lectures took place, attended two or three of them and became acquainted with the professors, visited and examined the collections, the stables, the brewery, the farm and experimental field, the sheep, &c.

The estate lying in connection with this institute comprises, I believe, about 650 acres, of which there are usually about 80 in wheat, over 40 in rape and root crops, about 35 in oats, 12 to 15 in potatoes, 15 to 20 in rye, 18 to 20 in barley, 8 to 10 in beans, 5 in hops, about 130 in fodder crops, such as lucerne, clover, vetches, &c., while about 150 are in mowing fields and so on. The land is of excellent quality.

The stock consists of 12 horses, 22 pairs of oxen, 59 milch cows, 7 young cattle, 30 swine, and 570 sheep. The cows are

mostly of the Allgäuer and Mürzthaler breeds, which are considered best for milk after the Dutch. The cross with the Allgäuer and Swiss, they say, makes fine working oxen.

The buildings form a series of parallelograms, enclosing a great grassy court, around which are arranged the various departments, as the chemical laboratory, the rooms for study, &c. Around a second court are the cattle barns, the dairy and stables, the granary, the brewery, the plough manufactory, &c. There are, also, various other establishments, a distillery, a flour mill, &c.

The number of students is about seventy. The course of instruction does not materially differ from that at Hohenheim.

During the summer term, for instance, there were lectures by the Director, on soils, their origin, the different kinds of soil, weathering, irrigation, drainage, division and natural classification; The comparative value of soils for the production of plants; Circumstances which modify this value; The soil differs according to the coarseness of its particles and its tenacity; Sand, loam, clay, marl and humus; Subdivisions of soils; Taxation of mowing lands, pastures, gardens, vineyards, swale lands, fisheries, &c.; Double-entry book-keeping as a check upon farming operations.

Dr. Riederer lectured upon the following topics:—

1. Introduction to agricultural practice, idea and object in general and the systems of Thaer, Thünen and Liebig.

2. The positive and negative means of a good farm management, as the judicious division of land, proper number of laborers, education of the farmer, necessary capital, &c.

3. Advantages and disadvantages of large and small estates. Influence of a judicious regulation of the corn trade, at home and abroad, on the profits of farming, &c.

4. The most important directions in regard to keeping animals and the proper estimation of their products.

Text-books are used in connection with the lectures.

Professor Knobloch lectured three hours a week upon—

1. Agricultural Chemistry.—Chemistry of fermentation, decomposition, formation of humus. The chemical contents of manure, excrements of birds, solid and liquid excrements of man and animals, strawy materials, disinfection. The chemical principles of the preparation of composts. Bone manuring, phospho-

rites, and koprolites, gypsum, wood and peat ashes. Manuring with oil-cakes, ammonia, and nitric acid salts. Fish guano. The formation of soil through the culture of agricultural plants. The chemical principles of fallowing and rotation. Drainage. Chemical analysis of soils and kinds of manure, the ashes of plants, of spring and running water, and of different agricultural products. On Liebig; Chemistry in its application to agriculture and physiology, &c.

In connection with these lectures, the chemical laboratory was open daily during the term, and the students worked industriously in it, in making analyses of soils, manures and ashes, milk, potatoes, feeding materials and cereals, sulphuric acid and phosphoric acid determinations, &c.

2. Agricultural Technology.—Four hours weekly. Fermentative processes of the beer brewery, the brandy distillery and vinegar manufactory in its whole range. Making of butter and cheese, making of starch, and the application of the latter to the production of sago. Lime and brick burning. Turf cutting.

Technological Practice, four half-days a week in the winter term, and one half-day in the summer term. Manufacture of Bavarian normal and strong beer, potato, grain and maize brandy, vinegar, starch, &c. Demonstrations in the brandy distillery, the cheese dairy, the brick-yard, at the lime-kiln, and on the turf or peat meadows. Investigation of various raw materials and fabrics. Agricultural technological mechanics. Excursions to farming estates in the neighborhood.

Professor May gave lectures in the winter term, five hours weekly, upon—

1. The anatomy of the horse, the sheep and the swine, with demonstrations by skeletons and preparations.

2. Physiology of domestic animals, in connection with the feeding proper for them.

3. The races of the larger farm animals. Study of the different races, breeds and families of improved domestic animals, their form, characteristics and useful qualities.

4. General principles of the production of animals. Methods and principles of breeding. Green, dry, root, bulb and corn fodder. Wastes of the farm. Loss and injury from particular feeding materials. Comparative composition of different mate

rials, and their nutritive value. Preservation, economy and production of fodder.

Summer Term, four hours a week.

1. Swine-breeding. Choice of animals. Pregnancy and care of the litter. Parturition. Treatment of the dam and pigs. Close confinement. Keeping at pasture. Fattening.

2. Horse-breeding. Study of the subject from an agricultural and a national economical point of view. Choice of draught horses. Pairing. Treatment of the mare in foal. Handling of colts during the first, second, third and fourth years. Checks in the development.

3. Knowledge of wool. Its normal and abnormal conditions.

4. Importance of a knowledge of veterinary science in the treatment of domestic animals.

Second Course. Winter Term, four hours a week.

1. On wool, (continuation.) Wool staple. The wool fleece. Evenness of wool. Cloth and comb-wools. Working of Wool.

2. Sheep-breeding. Choice of animals. Numbering and classification of sheep. Treatment of ewes in lamb. Time of lambing. Management of the young. Pasturing sheep. Washing and shearing. Sorting of wool. Treatment and sale of wool. Fattening. Valuation of the fodder used in sheep husbandry.

3. Cattle-breeding. Choice and selection of animals for breeding. Deviations from the normal presentation. Suckling and artificial raising of calves. General management in all cases.

4. External diseases of the larger useful farm animals.

5. Shoeing. Treatment of the ordinary breaks and diseases of the hoof.

Summer Term—Five Hours a Week.

1. Cattle breeding (continued.) Stall and pasture treatment. Use of cattle—milk, fattening and draught. Valuation of fodder to be used.

2. Knowledge of the exterior of the horse.

3. Knowledge of the exterior of cattle.

4. Internal diseases of domestic animals. Contagious diseases and their origin.

Practical exercises of judging correctly of animals, on the part of the students, also of wool; the true modes of breeding and the diseases of stock are constantly enforced.

Prof. Lidl lectures, in the winter term, on—

1. Cursory view of the geognostical relations of Bavaria.

2. Agronomy. Mould and subsoil, humus, sand, clay, lime, gravel and alluvial soils. Local aspects and their influence on vegetation.

3. Agriculture. Cultivation—working of the soil by cultivation, by different implements. Improvement of soils.

4. Anatomy and physiology of plants. Cells and vessels of plants. Difference in them. Contents of cells. Plant-cells in their various relations. Intercellular tissue. Nourishment of plants. Motion of the sap. Production by seeds and spores. Diseases of vegetation.

5. Morphology. Root, stem and leaf organs, flowers, fruits and seeds.

Summer Term.

1. Special plant culture—grain fodder and root-plants.

2. Economical botany. The most important weeds and poisonous plants.

Second Course—Winter Term.

1. Fruit culture.

2. Cultivation of special plants, root, commercial and coloring plants.

Summer Term.

1. Culture of special plants, grains, pulse and oil fruits. Fodder plants and tubers.

2. Wine growing.

3. Continuation of lectures on botany.

Two botanical excursions are made each week in connection with this course.

Prof. Döhlemann lectures, in the winter term, on—

1. Applied mathematics. Recapitulation of the most necessary principles of algebra, geometry and stereometry; calculation, division and alteration of surfaces; calculation of the cubic contents of different bodies.

2. General architecture. Earth and foundation work. Construction of ore pits. Restoration of hewn stone and brick-wall work. Stone binding for pillars. Chimney flues, &c.

3. Practices in drawing. Drawing of situations. Copying and sketching of simple agricultural buildings and parts of buildings. Drawing of agricultural implements and machines.

Summer Term.

4. Continuation of general architecture. Construction of different kinds of vaults; ornamental works; carpenter's work; joiner's and locksmith's work.

5. Surveying, with exercises in the field. Explanation of the most useful instruments for length and angle measuring. Solution of different problems of practical geometry, on the field and in practice.

Second Course—Winter Term.

1. Agricultural Architecture.—Laying out and construction of houses and stables. Buildings for the preservation of agricultural crops, &c.

2. Meadow Management, with practical exercises.—Theory and use of different levelling instruments. Water measuring. Improvements of fields in general. Drainage. Irrigation. Practice in levelling and water measuring.

Prof. Meister lectured, in the winter term, three hours a week, on physical geography, the atmosphere and climatology. The barometer, thermometer, hygrometer, and psycorometer. Effect of clearing off of forests. Relations of temperature to the atmosphere and the earth, and the consequent distribution of plants. Peculiarities of land and sea climate, and their causes. Winds. Warmth and moisture. Amount of rain, dew, number of rainy days, storms, fall of hail, and their distribution over the year, and the consequent physical characteristics of the soil. Explanation of the century calendar, and of the so-called rules for determining the weather. Temperature of the soil. Observations at different depths. Barometrical and thermometrical measurement of hights. Construction of sun-dials.

Judge Schleisinger lectured in the second course twice a week, in both terms, on the general German agricultural law in regard to the more important private rights and later laws in regard to cultivation.

This course was comprehensive, embracing the general principles of rights, persons and things, and the laws affecting property, real and personal.

The royal master of forests, Bierdimpfel, lectured in the winter term on the introduction to the management of forests, the structure of woods, plants, and their relation to the air, climate and soil, and on the definition of the technical forest expressions.

Summer Term.

On forest cultivation, protection of forests. These courses were illustrated by excursions into the neighboring forests belonging to the government.

In addition to the short and frequent botanical and other excursions in the neighborhood, long excursions are made, from time to time, to various parts of the kingdom, the students being accompanied on them by one or more professors. Special subjects are assigned to some one or more of the class on which to write out a detailed report. As an example, the last great excursion which took place previous to my visit was made to Northern Bavaria, to Nürnberg, and so round to Augsburg, to visit the wool market in that city. In the former city, there was, at that time, a great meeting of Bavarian farmers for the discussion of agricultural topics; an agricultural convention, in other words. That was taken into the trip. That part of the kingdom, as well as Franconia, through which the direction lay, is largely devoted to the culture of hops. Now two of the students were appointed to write out an account of the journey in general; three to write on the culture of the hop; two on fruit-culture, as seen in the excursion; another on irrigation; another on garlic-land; another on the art of manuring; four others on cattle; two others on the visit to Lichtenhof Agricultural School; another on bees; two others on the wool market, &c. A full report of the excursion is thus made, mostly written by the students themselves, and printed in connection with the annual report of the school.

The arrangement of the hours for the lectures at this school, is as follows:—

Arrangement of the Lectures, Winter Terms, 1862 *and* 1863.

Days of the Week.	Forenoon.						Afternoon.			
	8 to 9.		9 to 10.		10 to 11.		2 to 3.		3 to 4.	
	1st Course.	2d Course.	1st Course.	2d Course.	1st Course.	2d Course.	1st Course.	2d Course.	1st Course.	2d Course.
Monday,	Agricultural Chemistry.	Special Cattle Breeding.	Forestry.	Technology.	Anatomy & Physiology of Animals.	Management of Forests.	Agricultural Practice.	Technological Practice.	Agricultural Practice.	Technological Practice.
Tuesday,	Applied Mathematics.	Agricultural Practice.	Agricultural Chemistry.	Special Cattle Breeding.	Theory of Agriculture.	Agricultural Architecture.	Physical Geography.	Technological Practice.	Anatomy & Physiology of Animals.	Agricultural Law.
Wednesd'y	General Architecture.	Technology.	Theory of Agriculture.	Agricultural Practice.	Religion.		Physical Geography.	Forest Excursion.	Agricultural Mechanics.	Forest Excursion.
Thursday,	General Architecture.	Technology.	Anatomy & Physiology of Animals.	Agricultural Practice.	Theory of Agriculture.	Veterinary Science.	Agricultural Implement and Plant Drawing as a part of Technological Practice.			
Friday,	Applied Mathematics.	Special Plant Culture.	Anatomy & Physiology of Animals.	Technology.	Theory of Agriculture.	Special Cattle Breeding.	Physical Geography.	Technological Practice.	General Plant Culture.	Agricultural Law.
Saturday,	Theory of Agriculture.	Agricultural Architecture.	Agricultural Chemistry.	Special Plant Culture.	General Cattle Breeding.	Agricultural Practice.	Agricultural Implement and Plant Drawing as a part of Technological Practice.			

Hours for the Lectures in the Summer Terms of 1862 *and* 1863.

Days of the Week.	Forenoon.						Afternoon.			
	8 to 9.		9 to 10.		10 to 11.		2 to 3.		2 to 3.	
	1st Course.	2d Course.	1st Course.	2d Course.	1st Course.	2d Course.	1st Course.	2d Course.	1st Course.	2d Course.
Monday, .	Forestry.	Technology.	Chemistry.	Zoology.	Cattle Husbandry.	Forestry.	Forest Botanical Excursions.	Agricultural Practice.	Forest Botanical Excursions.	Agricultural Practice.
Tuesday, .	Cattle Husbandry.	Taxation.	Surveying.	Zoology.	Plant Culture.	Mowing Lands.	Work in the Laboratory.	Forest Excursion.	Work in the Laboratory.	Forest Excursion.
Wednesd'y	Farm Management.	Agricultural Architecture.	Architecture.	Technology.	Religion.	Religion.	Work in the Laboratory.	Practice in Exper. Field, Bot. Excur.	Work in the Laboratory.	Practice in Exper. Field, Bot. Excur.
Thursday,	Cattle Husbandry.	Technology.	Botany.	Zoology.	Chemistry.	Special Plant Culture.	Practice in Exper. Field, Bot. Excur.	Agricultural Law.	Practice in Exper. Field, Bot. Excur.	Leveling Field Measurement.
Friday, .	Surveying.	Taxation.	Cattle Husbandry.	Mowing Lands.	Plant Culture.	Zoology.	Surveying.	Agricultural Law.	Surveying.	Fruit, Wine, and Garden Culture.
Saturday,	Farm Management.	Special Plant Culture.	Chemistry.	Zoology.	Plant Culture.	Technology.	Practice in Agriculture.	Technological Practice.	Practice in Agriculture.	Technological Practice.

The nurseries on the farm are extensive and the sales from them profitable; but probably the brewery is the most profitable branch of the establishment. Here are used more than ten thousand bushels of malt a year. In the year ending with July 1st, 1863, it used 3,668 Bavarian scheffel, or about eleven thousand bushels. In the same year over a thousand bushels of potatoes were used in the distillery. There were sold from the nursery, in the same time, 8,520 trees.

Just before I was there a terribly destructive hail-storm had occurred, and I never saw such magnificent fields of wheat and other grain so completely riddled and ruined. It was painful to look upon. It had given promise of an extraordinary yield up to the time of the hail, but it was very nearly a dead loss when I saw it. A committee of appraisers from the insurance company for crops was on to estimate the damages. The widespread system of insurance, of which the institute had fortunately availed itself, saved it from very great loss, which otherwise would have fallen very heavily upon it.

I was indebted to Professors May and Döhlemann for many kind attentions. The director was much occupied with the people who were to estimate the damage of the storm.

I should add that much instruction is given in the field and the nurseries, in the barn and other parts of the establishment, by practical demonstrations. There is a reading-room and a library; there are extensive collections and other appliances.

SCHLEISSHEIM.

This is now a school of practical farming corresponding to the *Ackerbauschule* at Hohenheim, that is, the pupils are the sons of peasants mostly, and they enter the school to work a considerable part of the time. The number of students at the time of my visit was thirty-four.

This school was founded in 1822 as a higher agricultural institute like Hohenheim, but the lands at Weihenstephan being well adapted to the purposes of a model farm, the higher department was removed to that estate some years ago, leaving Schleissheim, and this latter has since remained as a school of practice. The estate consists of about six thousand five hundred acres, and like many other establishments of the kind, it possesses a fine old royal residence or chateau, the whole lying

in an immense, but not very fertile valley. I have seen it intimated that the lands were so decidedly inferior and unproductive that the intention of the government in giving it over to the school to be managed by scientific men was to put the value of scientific principles in agriculture to the severest possible test. I believe, if such was the case, that there has been little reason to exult in the triumphs gained over such powerful natural obstacles as a poor soil and an ungenial climate, and I think it may be taken to be as great a mistake to select land for a model farm, or an agricultural college farm, that is much below the average of natural fertility, as it would be to select one very much above it. In the first case even scientific management can hardly be charged with the responsibility of a failure to produce high crops, and in the latter, it would not get the credit of whatever it did produce. Neither would be a fair test of the skill and science applied to it.

The character of the soil led to the early adoption of a twenty years rotation, in which wheat came in but once, oats five times, rye and barley one year each, grass occupying six years, and one year being given over to an idle fallow.

The buildings are old and immense in extent, arranged in the form of parallelograms with broad open courts or yards between. The whole has an air of majestic desolation. I do not think palaces especially well adapted for the purposes of agricultural schools. The endless stables were partly occupied by horses belonging to the Bavarian cavalry.

The course of instruction is more practical than theoretical, that is, of the time devoted to study and training two-thirds is given to practical work and one-third to theoretical.

The theoretical instruction, which comes mostly in winter and on rainy days in summer, when it becomes impracticable to work out-doors, embraces—

1. Religion. A brief survey of the history of religion and biblical history.

2. Elementary studies, arithmetic, orthography. In arithmetic, the fundamental rules and fractions, exercises in reducing common currencies, weights and measures, and measurements of space. It is especially mathematics applied to agriculture. As large a proportion as possible is mental.

About an hour a week is devoted to orthography, to teach correct writing and language, and to develop facility in writing. It includes examples of receipts, bills, notices, &c.

3. Agriculture. On climate, atmosphere, knowledge and estimation of kinds of soil and their cultivation or working. On machines and implements, their manufacture and repair, the parts of which they are composed and their use, the handling and management of sowing, threshing and cutting machines, to guard against accidents. On the formation of manure heaps and the manufacture of manure, the application of different sorts of manure. On the knowledge of seeds, and the different methods of sowing and planting. The treatment of plants during the period of growth. The reduction of different feeding substances to the hay value. Estimation of the necessary requirements of manure. On the various methods of harvesting, threshing, preservation and drying. On the valuation of fruits. On the arrangement and keeping of simple farm registers. Plan and model drawing from measurement.

Technical Employments.—On milk and the products of milk. On the erection and management of brandy distilleries, and the suitable materials to use.

Culture of Mowing Lands.—Preliminary instruction. 1. Levelling by the application of the level and other instruments. 2. Measuring of level surfaces, lines, angles, and figures; triangles, quadrangles, right angles, the circle, practical exercises in these operations. 3. Laying out trenches and dams for water or irrigated meadows, calculation of bodies of water, and the requirements of water for irrigated meadows. 4. Tools for field culture.

The practical management of meadows. Study of meadow or field plants. Requirements of seed and time of sowing. Seed raising. Manuring mowings with barn and compost manures, with liquid and artificial manures; the hay harvest and its yield. Preparation of brown hay; care and improvement of meadows other than irrigation.

Drainage.—When and how to be applied. The work preparatory to draining.

Cattle Breeding.—Application of anatomy to horse, cattle, sheep, and swine breeding. The various breeds and their characteristics. Explanation of particular methods of improv-

ing the breeds of cattle, through the introduction of foreign males, and through in and in breeding, &c.

1. Explanation of characteristics according to the kind of use required, feeding for beef, milk and draught.

2. Choice of animals for breeding, according to age, use, special points.

3. Treatment of the breeding animal,—feeding and care.

4. Parturition. Treatment immediately after.

5. Management of the calf. Methods of raising. Quantity and quality of milk for its nourishment.

6. Feeding, management and care of the young animal up to the period of use.

7. The same of the full-grown animal. Quantity and quality of food for milking, fattening, and working animals. Housing of sheep, product of wool, and the cleansing of it.

8. Adaptation to work.

9. Purchase and sale of animals, especially the horse.

The students are instructed in veterinary manipulations, and so far as possible applied in practice. Bleeding at several points in different animals. Treatment of wounds, &c. Shoeing of horses and oxen.

The proper management of forests, in all its branches, also forms a part of the instruction, as well as that of fruit trees.

Excursions are also made to neighboring estates for the purposes of observation, the results of which are written out by the pupils. Money is sometimes appropriated by the government to defray the expenses of long excursions.

Experiments are conducted in the making of implements, and the application of manures, and the cultivation of plants.

There is a collection of models, a herbarium, a library, and tools, and workshops for repairing the smaller agricultural implements, and the preparation of models. The students are held to a pretty strict line of conduct; neatness, order, and industry are inculcated and required. An examination takes place at the close of the course, and prizes awarded according to merit.

The number of cows kept is ninety; the number of yokes of oxen thirty-six. They make cheese and butter. The age of the students varies from sixteen to twenty. The tuition, board, &c., amounts to about 80 florins, or about 33 dollars. Each

student costs the government about 125 florins, but the balance is made up from the public treasury.

The young men are certainly not liable to acquire luxurious habits here. I visited them, by invitation of Professor Anselm, teacher of agriculture, while they were at supper, and had various opportunities for conversation with several of them. Their fare appeared to be what, in our reformatory and correctional institutions, would be called "very hard," and yet they seemed to be quite contented and happy.

I should think the institution well calculated to send out a hardy, frugal, intelligent, industrious class of young men, who might testify with regard to their training as Socrates did with regard to Xantippe, "being firmly convinced that in case I should be able to endure her, I should be able to endure all others."

There is nothing imposing in the buildings or their arrangement. They are substantially built of stone, in low, long ranges surrounding a large yard or open space. There is a blacksmith's and a wheelwright's shop in a part of the range, and many agricultural implements are turned out here by the slow processes of hand labor, some of them excellent, but all rather more remarkable for strength than elegance.

Brown Hay.—They prepare here, and in many other parts of Germany, what is called brown-hay. When the grass is partially wilted, it is collected and spread in layers, and firmly trodden down. It is dried by the heat which is generated in the mow. If the wilted grass is to be thus made into hay, it must be taken when neither too juicy nor too dry. Leaves, heads, and blossoms must remain firmly on the stalk.

In good hay weather, the grass may be cut in the morning, and after being wilted and turned, and after lying six or seven hours, carted in and trodden down. The mow or stack may be from ten to twenty-five feet high. If not high enough, the grass does not generate sufficient heat, and moulds and injures. But if the stack is too high, the weight too great, the hay may become black and mildewed, because the warmth becoming too great, does not find its way off sufficiently fast. If the stack is put up outside the barn, under a straw-thatched roof resting on poles, they round it up very much in the shape of our stacks, not less than ten feet in diameter.

To preserve the hay, the treading must be carefully done, so as to get it as firm as possible, and to have it all trodden down uniformly. The firmer it is the better, and this is regarded as of the first importance, since it heats all the more, and the moisture is more completely driven off, till it soon becomes quite dry.

On the top layer of hay, from six to eight inches of straw is spread, that no mould may attack the hay on the top, and that the evaporating moisture passes into the straw. If the work is well done in building the stack, the hand cannot be pressed into the sides. Within a few days, the heat is so much developed that in thrusting in the hand it is very perceptible.

After five or six weeks, the heat is entirely gone, and the hay is very fragrant, and ready for feeding out. It is of a brown color when so treated, and hence called brown hay. In using, it is cut down perpendicularly with a knife, so that it comes off in vertical layers. It is a perfectly healthy and sound fodder, and is eaten greedily by stock.

The advantages of this method of curing hay are—

1st. That even in rather bad weather, the haying is quickly over.

2d. That the hay is more nutritious than that cured in the usual way. It is estimated as fifteen per cent. better. The reason of this is that with the wilted grass all the blossoms and flowers of the meadow grasses and the finer leaves are secured, which in working over in dried hay are, to a great extent, lost.

3d. That much less space is required to preserve it, because it is trodden so solid. For these reasons, this mode of curing is adopted in many sections. In this method of drying, where the amount of fodder is short, straw may be placed under the stack, in order to improve the straw by means of the heating whereby it becomes more soft and tender, and is relished much better by stock. If bad weather is feared, the grass may be got in much less wilted, and thus preserved by the mixture with straw. The greater moisture present in the grass is divided uniformly with the dry straw.

Bad, or what is called sour hay, if made into brown hay, is much more palatable to cattle, and all the more if a little salt is strewn over the layers.

Grass usually comes into blossom there, as with us, in the latter part of June or by the first of July, and that is regarded as the most suitable time for cutting it.

LICHTENHOF.

This institute is about a mile from Nürnberg towards the south. It was founded in 1832 by Dr. Weidenkeller. The farm, originally composed of sand and gravel, almost barren, was gradually changed into a good soil, now apparently fertile and productive, by the students.

The stately buildings of the institute stand at the right of the entrance, and on the left the botanic garden. The buildings are in a modern style, contrasting strangely with the antique structures in the neighborhood. The dwelling of the inspector is within the college enclosure, as also that of Mrs. Weidenkeller, and just beyond, the dormitories for eighty students, the lecture rooms, the laboratory, a spacious eating saloon, which serves also as a work room, a library and wash room.

The botanical garden contains all, or nearly all, the agricultural plants, arranged in the Linnæan order, besides many of the more common forest trees. The garden of the institute for the growth of vegetables and fruits also joins the botanical garden. Among the fruit trees stands the monument to Dr. Weidenkeller, the founder. A little way beyond lies the experimental field. The improved grounds near by contain a good nursery of trees. In a little grove, on a knoll, a monument is erected to His Majesty, King Max. A broad space is devoted to ornamental plants and farm crops. The experimental field is about two acres in extent. There is also a hop garden on a piece of reclaimed swamp. This piece was improved by the pupils without much cost.

Near the main building stands a second, which contains the collections. They consist of skeletons and anatomical preparations, a crocodile, birds, domestic game and some malformations, several models of systems of irrigation, collections of insects, minerals, &c.

The stocks of bees were presented by Dzierzon, and therefore of special interest. The mode of operation is easily seen from the arrangement of the hives.

The farm buildings consist of cow and horse stalls, shed and coach house. There were about thirty cows, consisting of Allgäuers and Simmenthalers, a few Ansbachers and Ellingers. The roof of the cow-house is built of wood, the sides of stone.

The instruction at this institute is not strictly agricultural. Much of it, in fact, has no more bearing on agriculture than on any other calling. Religion, the German language, geography, arithmetic, zoölogy and drawing are prescribed studies in the first year. Agriculture and practical agricultural exercises come in for a share of attention, but they don't seem to be especially prominent in the programme.

The second year is a continuation of the first, with a little botany, geometry, mineralogy and history added, while in the third year, agricultural chemistry, farm accounts, rural architecture, machinery, the anatomy and physiology of animals, veterinary, medicine, drawing, riding, fencing and other practical exercises come in and add variety.

This institute ranks as intermediate in the list of Bavarian agricultural schools. It has the advantage of close proximity to the market of the curious old city of Nürnberg, and is, I should think, in a tolerably flourishing condition. Nürnberg is in Middle Franconia, somewhat over a hundred miles north of Munich.

INSTITUTE AT GRIGNON, IN FRANCE.

I visited this celebrated school in company with Governor Wright, of Indiana. It was a beautiful day in August, and the excursion was, in many respects, highly interesting.

The improvement of the soil of the country, and a cheap production by means of this improvement; the advantageous employment in agriculture of the capital of the country; the continued occupation and elevation of the rural population of France, and the increase of that population, were the principles which led to the foundation of this establishment, in 1829. The great precept of the first director, M. A. Bella, was that the improvement of the soil is the most fruitful source of the cheap production of the necessaries of life.

King Charles X. bought the domain at Grignon, which was selected by M. Bella, and granted it, for forty years, on the following conditions:—

1. To apply a perfected and instructive system of agriculture on the domain.

2. To organize a scientific and practical course of instruction in agriculture.

3. To make all local and needed repairs.

4. To make permanent improvements to the value of 300,000 francs, such as buildings, roads, canals, clearing from rocks, plantations, &c.

5. To improve the lands in addition to the sum named.

6. To renovate the forests on the place.

It was started as a sort of joint stock company on these conditions, which were considered as very reasonable.

In other words, the estate being made over by the government on an appraised or fixed valuation, the subscribers were to furnish the capital to stock and carry on the farm, and to make permanent improvements in buildings, roads, drainage, &c., to the amount of 7,500 francs, or $1,500, a year, in lieu of rent. That amount was considered due, as rent to be paid in this manner. The government at the outset offered no further encouragement.

The subscribers to the fund regarded their stock as an investment, and not as so much given to the public, and they expected a return of interest on the capital invested. It will be seen that here was a difficult problem to solve; the management of the farm in such a manner as to show to the neighborhood and the country that the method adopted was better than others, which was necessary in order to secure for it a proper degree of confidence and respect, and at the same time to hire teachers and keep up the machinery of scientific and practical instruction, and after doing both, to make a net annual dividend to the stockholders.

To meet this somewhat anomalous condition, it was found necessary to be a little economical in salaries to teachers and professors, and thereby to sacrifice to some extent the interests of the people, to whom the value and efficiency of the enterprise as an institute of agriculture was of the first importance. The profits of the farm had to make up any deficiencies in the costs of the school, but the necessity of low salaries made it impossible to secure teachers of the highest talent, while the

price fixed for tuition, &c., put it out of the power of many students to attend the course.

The government, seeing very early in the undertaking that the company would be likely to have a hard bargain, very generously offered pecuniary aid in addition to the terms on which the estate was taken, but the director refused to accept it, fearing that it would injure the influence and credit of his farming, as an example or model for others, if it were known that any part of the funds came from sources other than the farm itself. The same objection could not be urged against the salaries of the professors being assumed by the government, and this enabled the school to secure a much higher grade of talent in its corps of instructors, while the terms were reduced so as to increase the number of pupils and the efficiency and importance of the school.

The director, M. Bella,—father of the present director,—in one of his earlier reports, makes the following sensible remarks:—

"Instruction in husbandry may truly be said not to partake of the nature of those branches of education which admit of being pursued in the centre of large cities; it is at once so vast and so complicated, and it stands so much in need of a union of theory with practice, that the chairs created in towns, though they may spread a taste for agriculture, cannot in themselves form expert husbandmen.

"If government were to feel itself called upon to carry on a system of farming operations in all their separate departments, in order to test the soundness of theories by the results of practice, many difficulties would occur in the execution of the task, and a much more lavish expenditure must, if we may trust to general belief, be incurred, than would happen if the same were in the hands of individuals. It is more prudent, therefore, on the part of the State, that it should associate itself with some scheme already in the hands of individuals, and even here its intervention would be prejudicial, if its co-operation were proffered to establishments which did not present in themselves sufficient guarantees, and if the assistance it afforded were not confined within proper limits.

"Thus it would plainly be a fault for it to mix itself up with any scheme, which did not possess the conditions of duration

necessary for the accomplishment of its proposed office; or which had not been proved to contain within itself the elements of success; or, lastly, which did not promise to establish by its results, that the coöperation of the government was designed solely for the advantage of the country at large, and not to promote the individual benefit of the company."

Thus the government came in simply in aid of a private speculation so far as to supply the means of a better kind of instruction, at a less cost to students who should enter the school of agriculture. The aid came in to enlarge the benefits of the institution, and to increase the means of diffusing agricultural knowledge.

The wisdom of the early interference and aid of the government is sufficiently attested by the subsequent history of the establishment. Carried on with the idea and expectation of profit, no expensive experiments could be undertaken, of course, and after the school had been some ten years in operation, the director excused himself, to a gentleman who called, for not making experiments, by saying that the school was supported by stockholders with whom it was an indispensable condition, that the farm should pay a profit; saying, at the same time, that the German schools like Hohenheim, being supported by government, ought to be expected to make researches calculated to throw light on the principles of agriculture.

The lands were poor and much run out, though various in natural quality. Now the lands are worth six times as much as they were when the enterprise began, while some hundreds of young agriculturists have gone forth, competent for advice and execution, to apply the principles of the improved culture in various parts of the world.

In 1848, the government took the instruction under its charge, reduced the number of professors from eight to six, transformed the royal institute into a regional school, and on the 7th of December, 1852, this school received the title of Imperial School of Agriculture. The management of the estate remained in the hands of the society, a sort of board of trustees, which bears the title of Agricultural Society of Grignon. The director is nominated by the council of the society and confirmed by the Minister of Agriculture.

The capital employed amounts to $80 an acre of the cultivated land, and includes the stock, fixtures, forage, grain, &c., that is, the whole working outfit of the farm. This capital pays on the average about 10 per cent.; a part of it goes to the share-holders, a part to the increase of implements, and a part to the establishment of a reserve or sinking fund, which is already about $16,000.

As to the farm, it was not necessary, to show the merits of improved culture and the benefit it can render to the country, to select lands already rich and productive. M. Bella refused other places which were offered, and chose Grignon, which was noted for its undesirable condition and the poverty of its soil. Many things were in its favor, however. The extent of the domain, the importance of the buildings, a large park walled in, a sufficient distance from cities, a very favorable climate, a soil so situated as to correspond to conditions farther south than even many places in the south of France itself, the neighborhood of the great markets of Poissy and Saint Germain, and of the celebrated flocks of Rambouillet, Videville and of Douarière, and that of Paris, with its great scientific and industrial establishments, its museum of natural history, its conservatory of arts and trades, while several great and practically model farms, which offered an opportunity for valuable practical instruction to the pupils were near by, and pointed to Grignon as the place to found a great agricultural institute.

The domain is situated about twenty or twenty-five miles west of Paris, and sixteen or eighteen north of Rambouillet, and consists of about 1,170 acres, of which 600 are arable, 70 or so in natural pasture, 10 in garden, 6 under water, 70 occupied by buildings, roads and gardens, and the balance woodland.

These lands are partly on a plateau, nearly 400 feet above the level of the sea, and partly in a valley rather abrupt, at the bottom of which runs a stream which rises at Versailles, about ten miles off. This valley embraces the park of Grignon, of about 750 acres in extent, enclosed. They formerly belonged to the immense estates of noble families, till divided at the revolution of 1793, when this part, the estate of Grignon, passed into the hands of the father-in-law of Marshal Ney, who was married there. It was bought by Napoleon I. and given to Marshal Bessières. Napoleon used to come there to hunt foxes.

The widow of Bessières sold it to Charles X. The Duchess d'Angoulême visited it in company with the Duke of Bordeaux, and afterwards the Duke of Orleans and the Duke de Nemours paid their respects there.

The soil near the brook in the valley is, in part, a rich alluvial deposited by the stream. This rests on a white chalk, colored with black silex, which constitutes the bottom of the valley. Plastic clay occurs a little higher up. Coarse limestone rises above this clay, and contains marl very rich in shells, perfectly preserved. Six hundred varieties are found in it. This land is very rocky. The calcareous parts of the soil are wanting in depth, and become extremely dry and hard in summer. They are valued in the neighborhood at from sixteen to forty dollars an acre. The climate is good. It is seventy-five or eighty miles from the sea. Peaches, trailed up in espalier fashion on the garden wall, were in full bearing when I was there.

The buildings are arranged in a manner little adapted to the objects of the institute. They are 1,200 feet from the lowest part of the valley, and separated from most of the farm by steep slopes, which adds so much to the labor account, that Thaer said he would never have consented to undertake to cultivate in such conditions. The chateau is of very simple and solid architecture, built of stone and brick, in the style of Louis XIII., the time when it was constructed. It forms an open square to the north, at the angles of which there are four pavilions. The principal body, towards the south-west, comprises, on the ground floor, the vestibules, the chapel, the eating saloons and the collections. On the second and third stories are the dormitories. The south pavilion contains the kitchen below ground, the offices of the agricultural society at the entrance, and those of the school and of the director on the second floor. The body of the wing and pavilion is appropriated to the director and his family.

The west pavilion and west wing include the halls and recitation rooms, the north pavilion the apartments of the assistant-director. There are open courts on the two sides, at the south-west of the chateau. The farm buildings, since they have been occupied by the society, have become quite insufficient, and many additions have been required in the shape of grana-

ries, pig-sties, sheep-folds, and a starch manufactory, which at least double the former capacity of the farm. The new buildings are simple and well-adapted to the end in view.

The stable is placed in the left hand side of the yard, the same as that occupied by the former residents of the chateau. It contains twenty, mares or gelded horses. The mare has been preferred on account of her quiet docility and lower price, and also because some attention is paid to breeding. Most of them are Percherons, and crosses with Percherons and Normans, and Bretons. Two are Suffolks, and two crosses of Cleveland Bays and Suffolks. The ox-stalls have ten head of the Swiss and Durham, Swiss and Limousin crosses. The stables for the dairy are placed at the north side of the two farm ways. They hold about a hundred head, of Normans and Swiss and some Shorthorn and Norman crosses, some Ayrshires, and some of the little Bretons.

A long experience has shown that at Grignon, the Swiss, which are the heaviest, are kept more easily than other races, even when obliged to keep them on poor and insufficient pastures, and that they are most profitable, that is, they give a greater yield of milk in proportion to food and live weight. The average yield of milk varies, generally, from six and a half to eight quarts per head per day for the year. Milk is the chief object of the dairy, because the production of milk gives a larger profit from an acre of forage than beef; but they try to combine the production of milk with a fat carcase, without feeding so high, however, as to lay on tallow. The bulls are worked daily. The herd is fed in the stable, as far as possible, but driven out for exercise each day, especially the young cattle. A herdsman has charge of from eighteen to twenty-two, feeding and milking them.

A piggery has been built by the society. It keeps from forty to forty-five sows, and four or five boars. They consist, mostly, of the English Berkshires and Hampshires, which have been bred at Grignon from the start. They are held in high estimation and much sought after, both for breeding and fattening. They have got up a white breed, which is a little more fine and delicate. The Grignon breed is very hardy and prolific, the average of pigs very rarely falling below sixteen for each female in a year. That is the general average of the sties. It is easily fed and

fattened. They easily obtain 270 pounds of pork, at eight months, and 450 at a year old. Young choice pigs are readily sold at $6 apiece, at four weeks old, and ordinary ones at $3, for fattening.

The sheep-fold was built for the purpose, and is capable of keeping 1,200 sheep and their food. The larger part of the flock is composed of a cross of Leicester-Merinos, in the proportion of three-quarters Merinos and one-quarter Leicester. This cross is now fixed at Grignon, and gives excellent results. The sheep are generally fattened at two years, and give, at this age, from forty-five to sixty pounds of mutton. The wool is long and can be carded, and is sold from two to two and a half francs the killogramme (of two and a quarter pounds.) The average weight of the fleece is about nine pounds, in the grease. They have also a small flock of South Downs, which is very much esteemed for the quality of its mutton and its easy keeping qualities. A shepherd has charge of from two to three hundred head.

They also keep some fowls and raise silk-worms, commencing in June and ending in July, but only enough to serve the purposes of instruction.

A part of the yard which separates the cow stalls from the hay and forage barn, is devoted to making manure, in platforms on which it is worked over. The attention of visitors is especially called to the process of making manure, a thing too often neglected in France; and yet the great and single problem to solve, in agricultural industry, is the economical manufacture of manure. Quantity, quality and cheap fertilizing materials, are the source of great profit and prosperity in farming.

The choice of cropping and the low price of forage, the rations, &c., modify the price of the yield and the quantity of manure produced; the process of manufacture acting directly on the quality, it will be useful to indicate, in detail, the care devoted to this preparation.

One man has special charge of this work. The manure platforms are sixty feet long and eighteen feet wide, and are carefully macadamized and made slightly convex towards the outer borders. A trench surrounds them and serves to conduct the liquids, which empty into a kind of manure cistern, placed between the two heaps.

Every morning the manure of the horses, oxen and cows, is carried from the stables and wheeled, in wheelbarrows, upon the platforms; there it is spread in layers regularly with the fork.

The sheep manure is carried out of the pens every three weeks, in winter, and every six weeks in summer. This warm manure is carefully spread in alternate layers with that from the pig-sties. The heaps are raised to a height of nine feet. The upper part is covered with a layer of earth to prevent evaporation, and to concentrate the gas generated by fermentation. The heaps are watered with the liquid accumulated in the trenches or cisterns, whenever it is necessary.

When the manure has come to its normal condition, the volume of the heaps has been reduced about one-third, and the cubic yard weighs about 1,690 pounds. There are 260 cubic yards to the heap. The number of these heaps made yearly is twelve to fifteen.

When the time has come to carry out the manure into the fields, the precaution is taken to cut it down with a manure knife in slices perpendicular to the platforms, in such a manner that the upper layers are mixed with the lower layers upon the cart. By this very simple mode the manure is equal and uniform upon the whole field. I examined this process with care, and its economy, where the labor is at command, appears to be proved by experience. The same mode could be adopted in many of our barn cellars, where much of the labor of wheeling would be saved.

There is also an implement manufactory established as an aid in the courses of engineering and rural construction. It furnishes the students the tools which they have learned here to use, while many farmers rely upon the Grignon manufactory for the tools in general farm cultivation. They say they have orders from the centre of France, from Portugal, Spain, Algeria and America, though I do not think we have occasion to order largely. At the World's Fair of 1855–6 the Grignon plough was the lightest of all, and took the great gold medal.

The tools made there, and used on the farm, are ploughs, and the gang ploughs, double and triple, are in high repute, harrows, cultivators, horse-hoes and scarifiers, rollers, seed-sowers, root-cutters, liquid manure pumps, carts, &c.

To the west of the chateau is a little building designed to furnish the pupils the means of cultivating a field of exercise and study. This building includes a stable and six head of cattle, a little barn, a collection of implements, another of cultivated plants, a granary and slaughter-house. On this place the students manage as they wish, going through all the operations incident to a large estate. Close by is a shed for making drainage tile, and a beet-root distillery, a starch manufactory, &c.

Depth of ploughing on the one hand and the abundance of the manures applied, as well as the character of the croppings and the rotation, distinguish the cultivation of Grignon over that of the general farming of France. They plough up the stubble as soon as possible after harvesting. This ploughing is designed for the destruction of weeds. The work is done with the double or triple plough, which is considered best for this purpose. The second ploughing is done with the ordinary plough, and when it is designed to sow colza or roots, another horse subsoil plough follows the third ploughing.

As they make about 6,750,000 pounds of manure a year, they use nearly 70,000 pounds per acre. This manure is half decomposed and buried to the depth of the ploughing to compel plants to push their long roots down towards the subsoil.

The domain is divided into nine courses, one of which is in natural meadow; that is, cultivated with the natural or true grasses; two for artificial meadows, lucerne, sainfoin and clover; one for annual forage, vetches, pease, Indian corn, &c.; and one for roots, the products of which are all consumed by the cattle. So that five-ninths of the area are designed to keep up the fertility of the soil, while four-ninths only are reserved for exhausting plants, the cereals and colza. Adding to this the fields lying along the brook, we see that the course of cropping adopted is decidedly ameliorating. They feed 900 pounds live weight of cattle per acre, on an average. Nor is the rotation adopted less calculated to improve the soil than the course of cropping, because it places the artificial meadows—clover, lucerne, &c.,—in the most favorable conditions, close to the root crops, which are abundantly manured, and it alternates carefully the cereals with hoed crops which clean the land and

prevent its exhaustion. The manuring is not wholly used up when another is added, as will be seen in this course.

1. Roots, strongly manured.
2. Cereals, mostly spring grains.
3. Clover.
4. Wheat.
5. Annual forage, for soiling cattle, half-manured.
6. Colza.
7. Wheat.

There is, sometimes, a deviation from this rotation, lucerne sown instead of clover. Oats follow the old lucerne, and spring and autumn wheat follows roots. This rotation divides the labor over the season advantageously.

The potato once stood at the head of the rotation at Grignon. It contributed much to improve the calcareous soils newly turned up. They cultivated first a late yellow variety, which produced on an average from 330 to 350 bushels per acre. Since the appearance of the disease, they cultivate an early yellow variety, which does not yield more than from 160 to 275 bushels.

The beets, first cultivated for the immediate consumption of stock, had the best part of the rotation of roots. It was a variety of the Silesian, with the long neck, yielding largely. After that the yellow globe was preferred. But since the lands have been improved and the distillery was built the roots go first to the distillery and then to the stock, so that the sugar beet is cultivated. The *Rose of Flanders*, and white Magdeburg, comprise the greater part of the roots cultivated. They are sown with the Grignon seed-sower. The yield varies from 36,000 to 74,000 pounds per acre.

The carrot is the most expensive root cultivated, and yet it is the most profitable on account of its great yield. Carrots are grown for horses and to vary the root fodder of horned cattle and lambs. The varieties are the white, with the green neck and the long red. The average product per acre, 40,000 to to 60,000 pounds.

The artichoke served as a transition crop to improve poor, calcareous soils, which it occupied for several years without receiving any manure. It has been since cultivated in the same conditions as other roots. It yields from 22,500 to 31,500

pounds of roots, on an average, per acre, and 2,700 pounds of stalks which, when cut, are mixed with the residue of the distillery and fed to cattle.

Wheat, sown in spring after roots, manured and on a single ploughing, has regularly given results which compare well with winter wheat, not only in point of quantity yielded, but in weight and quality. The general yield is from twenty-seven to thirty-eight bushels per acre. Mixture of wheat is common there, and succeeds well.

The oat cultivated there is brown and small. It yields well. It is the Houdan oat. Average product from thirty-three to sixty-six bushels per acre.

The variety of barley is the two-rowed. Its average yield is from thirty-three to forty-five bushels per acre.

Clover would not succeed well at first, at Grignon, and was not cultivated. Now it yields excellent crops, amounting to from 2,700 to 4,500 pounds per acre.

The high cost of vetches for seed and the advantages of Indian corn for green fodder have led to the extensive culture of the latter, but they cultivate all the kinds of green fodder from the earliest to the latest. Grignon first introduced the *Moha de Hongrie*, or Hungarian millet, which has succeeded admirably.

Colza, after having been cultivated by sowing in rows, is now always transplanted.

Sainfoin formerly was cultivated alone but is now mixed with lucerne and clover, in order to render the meadows more suitable for pasturing sheep. Lucerne is sown at the rate of twenty-two pounds per acre. The variety which has given the best result is that of Provence. It yields from 2,700 to 5,400 pounds per acre. The farm cuts not far from about 300 tons of hay, including the lucerne and clover. About forty-eight acres are in natural meadows, that is, in Timothy, redtop and similar grasses.

It is a precept of the school at Grignon that the land is a machine which it is best to improve, whenever it is in favorable economical relations, in order to make it work as well as possible. The improvements accordingly commenced on the poorest, or, at least, the most exhausted lands, and they have been pretty complete.

Though the imperial school was detached from the charge of the agricultural society the *personnel* of instruction and the relations of the students, with the body carrying on the farm, have not changed. The society and direction furnish, as formerly, all the means of study and investigation that can be desired. The school and the farm are under the same director.

The pupils are required to work four hours a day, and are successively charged with different service on the farm, which they are called upon to observe daily. They assist from four and a half in the morning, in the order of work which the director gives to the different chiefs, and in the evening they assist in the daily reports which are given in to the director, and in entering upon the books the reports upon all the operations of the farm. The labors which they perform are various. They comprise the cultivation, the care of animals, the manufactories, the permanent improvements, building of roads, the care of the forest, the gardens, &c. They attend, during the visits of the veterinary surgeon, in the cattle stalls; they curry the cattle and horses, and perform various operations under the directions of the heads of the various branches. Each pupil is obliged to make a detailed report to the director upon the work he performs, and is allowed to make any suggestions he may see fit, which are accepted and acted on when practicable.

This constitutes the practical part of their education. Two are appointed as general inspectors under the orders of the director, and the duties alternate; that is, a certain number has charge of one department for a certain length of time, say a week or a month, and then they are assigned to another department in succession; as, for instance, four may be charged with the management of the oxen; two with that of the horses; two with the pigs; two with the sheep; two with the poultry; four with the silk-worm establishment; forming thus a sort of committee on each branch, the duty of which is to see that proper attention is paid to all the details, as among stock, to see that it is properly fed, to note the results of any changes of feed, &c. So, too, with the garden; two or more are appointed; two on woods and plantations; two to inspect the repairs and improvements going on; two on the manufacture of starch, cheese and other manufactured products; two on book-keeping and accounts, &c.

I believe the practice is to have one of the two on each committee of two years standing and the other a newly-entered pupil. At the end of the week all are required to make a report in the presence of the whole school, when the professor comments or enlarges upon the various operations going on, and gives such additional information as may be suggested by the facts presented. In addition to this exercise, which has the effect to train the young men in the art of composition and the skilful use of language, as well as to keep them informed of the working of the whole system, the professor takes the classes to see the various operations on the farm, pointing out the most approved method of performing them, &c. He lectures thus on the different practical processes of farming at the seasons when they actually take place.

Each professor, in his own department, moreover, is expected to give his instruction a practical turn, by means of short excursions, botanical, geological, &c.

It is thus they are initiated into the daily routine of the farm, and become the active agents of this great rival administration. Whenever an interesting experiment is proposed by a student, the director puts the machinery, animals, &c., at the disposal of the professors or tutors, and the pupils are designated to make the investigations.

The school takes only inside pupils; that is, they must all live on the place. No one is admitted except on a preparatory examination at the chief place of his department, and final trials also take place at the school. The candidate must be seventeen years old, and be a Frenchman or a naturalized citizen. Whoever desires to enter must address his application to the Minister of Agriculture, on or before the 25th September of each year, with certificates—

1st. Of the place and date of birth.

2d. Certificate of the mayor of his residence, to the effect that he is of good life and morals.

3d. Of a physician, that he has been vaccinated, and has had the petit varioloid.

4th. An obligation, on stamped paper, by the parents, tutor, or guardian of the candidate, to guarantee the payment, a term in advance, of his board during his sojourn at the school.

After passing the examination at home and having got the authority of the Minister of Agriculture, they repair to Grignon on the morning of the 1st of October, present themselves to the director, who gives each a number in the order in which they will be examined. This examination embraces the following :—

In arithmetic, the four rules, fractions, extraction of square and cubic roots, proportions and progressions, and the rule of three.

In geometry, propositions relative to straight lines, angles, circles, measuring of lines and plane surfaces, equivalent to the first four books of Legendre. In physics, the general properties of bodies, the thermometer and the barometer.

A composition in French is also required, to show the orthography and grammar of the applicant. When the trial is ended, the admission is declared according to the order of merit. The number of new pupils is limited. When admitted, they enter immediately upon the duties assigned them.

The duration of the studies is three years, after which the capable and meritorious students receive a certificate. The best students, on going out, can have positions for two years in some of the agricultural establishments of the government.

The school year begins the first of October, and is divided into two terms. At the end of each there is an examination by a committee. The first term is five months, and the general examinations at the end of the first term take place from the 1st to the 15th of March. Then the second term begins, and comprises the last half of March, the intervening months till August, when the vacation begins.

The instruction is theoretical and applied. The first comprises—

1. A course of physics, chemistry, mineralogy and geology, applied to agriculture.
2. Rural engineering.
3. Cultivation.
4. Zootechny and agricultural zoölogy.
5. Sylvæculture and botany.
6. Economy and rural legislation.
7. Practical notions of farm accounts.

The practical instruction is manual and rational. It comprises the use and management of farm tools, implements,

carriages, machines; the organization and execution of the principal operations of agriculture, ploughing, sowing, seeding, harvesting, treatment of root crops, care of farm stock of every kind, exercises in linear drawing, surveying, laying out plans, levelling, getting the cubic contents of solids, some of the manipulations of the laboratory, analysis of soils, application of manures, &c. Agricultural excursions are made, as well as botanical, geological, and forest. Instruction is given by observation in the horse and cattle stables, and by demonstrations on the field. In each speciality of theoretical and practical instruction, the professor is aided by a tutor. All these courses, examinations, &c., are expressly obligatory on every pupil.

There is a chaplain and a physician attached to the school.

The price of board, &c., is $150 a year. It includes food, lodging and bed, medical attendance, warming, lighting, and washing.

Prizes are distributed among the most deserving pupils.

There are three of these imperial schools of agriculture in France, but Grignon is the largest, as well as the oldest and best, though the regulations, terms of admission, course of instruction, &c., are the same in all.

The number of pupils at Grignon is usually seventy-five.

CIRENCESTER.

The agricultural college of Cirencester, in England, is situated in Gloucestershire, about ninety-five miles from London. It was incorporated on the 27th March, 1845, for the purpose of affording a practical and scientific agricultural education to students from all parts of the kingdom.

I visited it in June, taking letters of introduction to Prof. Voelcker, who has, for some years, held the chair of agricultural chemistry; but who, like most of the other professors, had resigned, and was about removing with his family into London. Owing, partly no doubt, to the peculiar mode of management, this institution does not appear to have commended itself very strongly to the confidence and good-will of the people, and hence it has proved to be a partial, not to say a complete failure. It has now a debt of £30,000 or $150,000, which is a source of great embarrassment, in addition to the various other causes of ill success, which need not be stated in detail here.

When I was in London, in 1862, all the professors resigned their positions, and most of them, I believe, left; one or two, only, having been persuaded to hold on, to save the institution from utter ruin. It only adds another to the list of instances, which might be given, to show that success or failure will depend very much upon the man at the head, however great may be the incidental advantages which may concur in favor of such an enterprise.

A mistake appears to have been made at the outset, by fixing the charges too low. It was designed to meet the wants of those young men, sons of farmers, who wished to prepare themselves for stewards or bailiffs; and who could ill afford to pay even the £30, which was the amount fixed, including board and tuition. Small farmers could not send their sons, and rich ones would not. But if an ungovernable lad had been rejected or dismissed from other schools, he was pretty sure to turn up here, and the consequence was the college got a large proportion of all the naughty boys in the kingdom.

The enterprise was started, at first, as a joint-stock company, the stock being taken up by subscription; and the concern was governed, or rather, there was an effort made to govern it, by a full board of the subscribers. Such an arrangement, as might have been anticipated, worked badly; and after running a hundred and twenty-five thousand dollars in debt, with no means of paying, a few noblemen came forward to assume the debt and the management. They raised the charges and attempted to put the establishment on a different basis.

They do not appear to have remedied the difficulties to any great extent; though the institution still lives, with about sixty students, now consisting of the sons of the rich. I am indebted to various individuals for many facts in regard to the college, in addition to my own observations on the spot, and I draw, also, from the printed programme that was placed in my hands.

Objects.—The chief object of this institution is to afford such a course of education, as will be most useful to those whose destined profession is to connect them with agriculture, at home or in the colonies, whether as owners or occupiers of land, land agents or stewards.

The College Buildings.—The college, which adjoins the park and woods of Earl Bathurst, is situated on the farm, about a mile and a half from the town. The principal front, 190 feet long, has a south aspect, and commands an extensive view over North Wiltshire. The buildings include a chapel, large dining hall, library, museums, lecture rooms, laboratories, class rooms, private studies, kitchens and servants' offices; with apartments for resident professors, and ranges of dormitories on the upper floors. The whole building is lighted with gas, and furnished with ample supplies of water. The best methods of warming and ventilation have been adopted. Each student has a separate sleeping apartment, and private studies are allotted to the meritorious students, as they become vacant.

The Farm.—The farm, which surrounds the college, contains about 500 acres, of which 450 are arable, of a varied soil and character. The farm buildings are spacious, and well adapted for carrying out the purposes for which the college was founded. A steam engine, with improved mechanical arrangements, furnishes all the power for threshing, grinding, &c.

Live stock, of various kinds, are bred and reared on the farm. Experiments are tried on portions of the various rotations; and where the results are satisfactory, they are carried out on a larger scale. A botanical garden, of ample extent, enables the professor, under whose charge it is, to instruct practically in the botany of agriculture; and to show to the students various experiments in vegetable physiology.

The Veterinary Hospital, is under the immediate superintendence of the professor of the department, assisted by a curator selected from among the more advanced students. Animals of all kinds are received for treatment, so that the students have opportunities of witnessing operations and *post mortem* examinations.

Museums.—The college possesses a valuable collection of geological specimens, minerals and other objects of natural history; also an interesting set of anatomical and pathological preparations—such as casts of teeth, to illustrate the age of the horse, sheep and other animals; and is now provided, by the gift of Messrs. Peter Lawson & Son, of Edinburgh, with the extensive museum of economic botany, prepared by those gentlemen for the international exhibition of 1862. This collection

contains specimen plants of nearly all the varieties of known cereals, samples of seed of every species of plants used by the agriculturist, and also a series of wax models of every variety of cultivated roots.

Management.—The management of the whole establishment of the college is committed to the principal, who is responsible to the council for every thing, and superintends and controls every department of the college. He attends to the religious instruction and moral discipline of every in-student, and exercises such supervision over the conduct and pursuits of the out-students, as the nature of their relations with the college will permit.

Agriculture.—The instruction in agriculture, consisting of lectures and practical classes on the farm, is given by the professor of practical agriculture, who is also the farm manager, residing on the farm, where students have every opportunity of becoming acquainted with and taking part in the manual operations of husbandry. They thus acquire a practical knowledge of the management of labor; of the uses of the different implements; of the application of steam machinery to farming purposes; of the breeding, rearing, feeding and general management of all kinds of stock; and of the rotation of crops, and their fitness, more or less, for different soils.

Each student is expected to keep a daily journal of all the operations on the farm, and to make himself thoroughly acquainted with the accounts.

Chemistry and Chemical Manipulation.—A well-appointed laboratory is devoted to instruction in chemical manipulation and analysis, which are taught to each class of students in succession, under the superintendence of the professor of chemistry and his assistant.

The students, after studying the properties of the more commonly occurring substances, are made to analyze a series of compounds, proceeding from simple to more complex cases; after which they apply the knowledge, thus obtained, to the analysis of manures, soils, ashes of plants, farm products and other substances more immediately useful to the practical agriculturist.

Analysis of artificial manures, oil-cakes, waters, &c., for members of the Royal Agricultural Society, and others, are

daily performed in the college laboratory, and chemico-agricultural researches undertaken by the more advanced students, under the immediate direction of Dr. A. Voelcker and assistants.

Geology.—Besides the lectures delivered on geology, the students are instructed by accompanying the professor of geology in field excursions and geological surveys in the surrounding neighborhood.

Entomology.—Lectures on entomology are delivered weekly, and students are encouraged to make collections of insects.

Botany.—A complete set of lectures on systematic botany, illustrated by a botanical garden, is annually delivered; and the professor of botany conducts botanical excursions weekly, during the summer and autumn months.

Veterinary Medicine and Surgery.—Instruction in this department includes a complete system of anatomy and pathology. Pupils are required to note all hospital cases in their journals.

Surveying and Civil Engineering.—In this department is embraced instruction in those mathematical subjects, which are connected with surveying, engineering, &c.; regular and frequent opportunities being afforded for practical instruction in the field in surveying, levelling and land measuring, and in the use of the theodolite, spirit level and other instruments.

Architectural and Mechanical Drawing.—A certified master, from the science and art department of the committee of council on education, South Kensington, teaches these subjects.

Admission.—The principal will furnish the necessary forms for the admission of in-students, who are required to be sixteen years of age.

Out-students are admitted to attend the lectures and avail themselves of the practical instruction of the institution. During their pupilage they are amenable to the college regulations, under the penalty of forfeiting their fees; which are also liable to be forfeited, in the event of any serious misconduct being brought under the notice of the public authorities. Except in certain cases, out-students are required to be one-and-twenty years of age.

Vacations.—There are two vacations in the year, each extending over seven weeks; the commencement of the summer

one being about the 18th of June, and of the winter one, the 18th of December.

Charges.—Per annum, to be paid half-yearly in advance, in-students, £90; out-students, £42.

There are a few private rooms in the college, appropriated to the students' use, for which there is an extra charge of £21.

These terms include every thing, except medical attendance and books.

A quarter's notice of the intention to remove any student, must be given by the parent or guardian to the principal, or a quarter's fee will be incurred. Students residing, or having their names on the books for any part of a quarter, will be charged the fee for the whole quarter. The college quarter days are January 6, April 6, July 6, October 6.

The college diploma or certificate—which admits those holding it to the position of graduate, under the title of member—is granted only to those who, at their final examination, show that they are thoroughly masters of the subjects of the various lectures, and are, besides, well acquainted with practical agriculture. Nor is this, or any other certificate, granted to students whose conduct has not given entire satisfaction to the authorities. The names of the members appear in the prospectus.

Copies of a set of examination questions, on the subjects of one session or half year, are also annexed. As these questions are all taken from the lectures and practical instruction previously attended by the students examined, they are well calculated to show what is taught at the college.

A scholarship of the value of £40 per annum, and tenable during three sessions, is given to the first man in each session. Students who enter at the quarter are allowed to compete for this, but are required to obtain for success five per cent. more marks.

It happened to be vacation when I arrived, and therefore I had not the good fortune to see so much of the practical workings of the college, as I should have been glad to have seen; still I visited the collections, the lecture rooms, the laboratory and the farm, in company with Dr. Voelcker and Prof. Coleman,

the manager of the farm, and saw the whole system adopted, as well as could be expected under the circumstances.

The farm appeared to be under a good state of cultivation. All the labor is hired, the regular farm wages being seven shillings a week, the laborers finding themselves. That is twenty-eight cents a day. Good ploughmen get as high as twelve shillings a week, and in harvest time three shillings a day.

They had about 500 sheep at the time I was there, but they usually winter about 700. They were mostly Cotswolds, and looking finely. The farm buildings are of stone, plain and substantial. The fattening animals are kept constantly in boxes, the best size of which, it is thought there, is 9 feet by 9, on account of their treading the manure better in small boxes. They consider the Yorkshire pigs the best and most profitable. Some of them were immensely fat, having been prepared for the Worcester exhibition of the Royal Agricultural Society.

The answer to the question why they got them so fat for that purpose, was that others do, and they are obliged to conform to the practice or fail, though the manager appeared to disapprove of the practice.

Among the crops were many acres of horse beans. The yield is 40 bushels per acre, 56 lbs. to the bushel, and one ton of straw. They are sown at the rate of 3 bushels per acre, in drills 17 inches apart. They grind them up, and give them to horses, sheep, &c. The wheat was at its full growth, and looking very well. The farm horses are Clydesdales. They are large and very useful animals, easily kept in condition. I should think they would weigh from 1,200 to 1,400 lbs. There are various facilities for work, such as a steam-engine, which does a great many kinds of work, like threshing, grinding, winnowing, &c. There is also a blacksmith shop on the place.

Experiments were being carried on upon the wheat fields upon a pretty large scale. They are of considerable interest and importance, but an enumeration of them would lead too far.

The following questions at the final examination for the diploma, will indicate the nature of this trial, and at the same time the course of instruction which had been pursued:—

PRACTICAL AGRICULTURE.—*First Paper.*

1. Enumerate the crops at present growing on the Royal Agricultural College Farm, naming that which each field bears, or is being prepared for, and the acreage in each crop, as nearly as you can recollect.

2. Describe the acts of husbandry during the present session, in lots Nos. 11, 19, and (3 and 5,) and the objects kept in view in each.

3. Describe and value the acts of husbandry during the present session in lot No. 8, and their object. State generally the best methods of cleaning (1) strong clays, (2) moderately light soils.

4. Describe (very briefly) the principal implements employed on the Royal Agricultural College Farm, and give a catalogue of those which would usually be required on a farm of 400 acres of turnip land.

5. Give an account of the different methods of planting potatoes according to the nature of the soil. Illustrate this from the plan adopted in 3 & 5; enumerate also the manures used for this crop in that field, and their apparent result up to this date.

6. What are the uses of the different kinds of root crops? What soils, what climates are best adapted to each sort respectively? Show how far one sort of root crop can replace another. What species of root will best take the place of an early spring green crop?

7. What is the best method of cultivating barley? How would you manage the previous crop, so as to insure a good seed bed? State the quantity of seed, and the soils best suited to this crop.

8. Write a short essay on parallel drainage, paying attention to—

(1.) The nature of the soil for which the system is adopted.

(2.) Depth and frequency of drains.

(3.) Action of parallel drainage.

(4.) General cost, and the return that may be expected from it.

Second Paper.

1. Explain the principles and use of the liquid manure drill.

2. What is the use and object of a rotation of crops? Describe a three, four, and five-field course, and state to what description of soil each is respectively adapted. Give examples when you can from the college farm.

3. At what period (1) of the year, (2) of the rotation, would deep ploughing be advisable? What kinds of soil does it benefit, and when should it be avoided?

4. Explain the functions of live stock on a farm. What effect has turnip husbandry produced on the meat-eating population of this country?

5. State briefly a few particulars relating to the breed of short-horned cattle, mentioning any remarkable sales or favorite lines of descent of the breed.

6. Of what component parts does milk consist? Shew the use of each of them in the dairy.

7. Describe the general management of the fatting and breeding flock during the present session.

1. Explain the difference in posting a cash and a credit transaction, and show how the following transactions would appear in your Journal and Ledger:—

June 10, 1857, Sold Mr. Thos. White 28 qrs. Wheat at 50s.
Bought 10 qrs. Oats of Mr. Jones, at 26s. and paid for the same.
Received from the Gloucestershire Banking Company £123 5s.
Hired Thrashing Machine of Mr. Slatter, 3 days at 25s.

Inorganic Chemistry.

1. Mention the preparation and properties of ammonia.

2. Describe the general properties of ammoniacal salts, and the mode of detecting adulterations in sulphate of ammonia.

3. Mention some manuring matters which owe their efficacy to the ammonia they contain.

4. How do you ascertain the presence of ammonia in a substance, and how do you determine it quantitatively?

5. Give a short definition of the following terms:—alkali, base, acid, salt, metal, metalloid, neutral, basic, mineral, organic, combination, mixture, soluble, volatile, and fix.

6. State in a general way the composition of mountain limestone, cornbrash, forest marble, and lias-lime and magnesian limestone, and their relative agricultural value.

7. How much oil of vitriol must be added to 1 ton of bone-ash in order to render all the phosphate of lime in it soluble?

Composition of commercial bone-ash:—

Moisture, ...	6.05	
Organic matter, . .	1.03	Equiv. of Ca=28
Phosphate of lime, .	75.84	" " P =32
Carbonate of lime, .	7.04	" " S =16
Sand, ...	9.88	
Alkaline Salts, . . .	.16	
	100.00	

8. How do you detect the presence of alum in bread?

9. Describe the preparation and properties of alumina.

10. A liquid contains soluble phosphate of lime, gypsum, and sulphate of ammonia; how can you recognize these compounds?

Organic Chemistry.

1. Explain the following terms:—decay, fermentation, and putrefaction.

2. In what respects do organic acids differ from mineral acids, alkaloids from alkalies?

3. Mention the proximate and ultimate constituents of wheat, potatoes, turnips, clover, pease, and cabbage.

4. State the composition of woody fibre, gun-cotton, starch, milk-sugar, lactic acid, and cane-sugar.

5. What are the changes which organic matters, containing nitrogen, undergo during putrefaction?

6. What is the chemical constitution of fatty matters?

7. Describe the preparation and properties of urea.

8. Mention the adulterations which are sometimes found in milk, and the mode of detecting them.

9. Write a paper on the chemistry of brewing.

Agricultural Chemistry.

1. What are the sources from which plants derive their nitrogen and carbon?

2. When is it desirable to preserve as much as possible the organic matter in soils, and when may it be destroyed without injury to the land?

3. How do you ascertain the commercial and how the practical value of manuring matters?

4. What is the composition of blood-manure?

5. Describe the preparation and properties of a good super-phosphate, and give reasons why it is more economical to buy this manure than to prepare it on the farm.

6. Write a paper on guano, stating the properties and composition of good Peruvian and of inferior guano, the adulterations in guano, the mode of detecting them, and the crops most benefited by guano.

7. What is the composition of liquid manure and its agricultural value?

8. Can sewage economically be converted into a portable manure? Give reasons.

Anatomy and Physiology.

1. What general principle should regulate the breeder of stock in the selection of animals for that purpose?

2. What diseases are likely to be transmitted from parents to offspring?

Describe the general anatomy of the foot, remarking on the differences in the organ of ox, sheep, dog, and pig, as compared with the horse; concluding with a consideration of the principles of shoeing, as applicable to the colt as well as to the adult horse in active work.

Pathology.

Write a description of the disease of diarrhœa occurring in horses, oxen, and sheep; including the subjects of causation; the elements of the disease, symptoms, stages, and results, with the principles on which the treatment should be founded; explaining the variations in practice in the several cases of the horse, ox, and sheep.

Describe the following diseases of the foot:—corn, quittor, foot-rot, foul, and canker; pointing out the causes, symptoms, and treatment; explaining the consequences of each affection, probable duration, and influence on the animal's soundness.

Geology.

1. Give an account of the geology of phosphatic deposits, as they occur in the different stratified rocks of England.

2. Describe the English new red sandstone formation, having particular reference to the following points:

I. Its geological and geographical position.
II. Its subdivisions and their characters.
III. Its minerals and economic materials.
IV. Its fossil contents.
V. The importance of a correct knowledge of this rock in a coal diagnosis.

The spirit of *caste* so prevalent in England has probably been the cause of the failure of this college to meet the expectations of the friends of agriculture, or to commend itself to any considerable portion of the people. I could not learn that it was popular with any class. They are waiting for something to "turn up," but in the meantime an enormous debt hangs like an incubus upon the college. Its future is therefore doubtful.

THE ALBERT MODEL FARM, GLASNEVIN.

The Albert National Agricultural Institution, near Dublin, was the first that I visited. I had landed at Queenstown, chiefly for the purpose of seeing something of the system adopted in these institutions in Ireland, and after visiting Cork

and Kerry, which lie on the way, I lost no time in introducing myself to Dr. Kirkpatrick, the chief inspector of agricultural national schools in that country. His head-quarters are at the Albert model farm. Through his kindness I was very soon put in the way of whatever information I might need, both in regard to the practical working of the school at Glasnevin, and the farm on which it is located, and in regard to the system of agricultural instruction throughout the country.

Among other things placed in my hands, was a little hand-book of the model farm, by Thomas Baldwin, the lecturer on agriculture there, and from this I condense a good many of the following facts relating to the buildings, the farm, the crops, &c.:—

This institution was established in 1838 by the Board of National Education in Ireland, and is designed to supply such instruction in the science and practice of agriculture as will qualify young men for becoming farmers, land-stewards and teachers of agriculture.

The institution, which stands upon the farm, is about three statute miles from the city of Dublin, and but a short distance from the Royal Dublin Society's beautiful botanic gardens, which are in the immediate vicinity of the village of Glasnevin, which has a historic interest from the fact of its having been the residence of Addison, Delany, &c.

The building, which is massive, but without architectural beauty, comprises dormitories, dining and school rooms, library and laboratory, in addition to apartments for resident officers of the institution, and a considerable range of farm offices.

The ground attached to the Albert institution is appropriated as follows:—

	A.	R.	P.
For farm purposes, ...	169	1	2
Gardens and pleasure grounds, .	10	0	22
	179	1	24

Two classes of pupils attend this institution, viz.:—

1st. Externs, or non-resident pupils, who board and lodge at their own expense, within reasonable distance of the model farm, and who are admitted on the following terms: First, that

each pays an entrance fee of two guineas; second, that they engage in the ordinary farm work; third, that they attend the lectures punctually; fourth, that they be amenable to all the rules and regulations of the institution.

2d. Interns, or young men who intend to become land-stewards or working farmers, and who are boarded, lodged and educated at the public expense for a period of two years.

In June, 1860, the commissioners decided that admission to this class shall, in future be obtained by competitive examination.

A candidate is expected to possess the following qualifications:—

1st. A certificate from a clergyman of his religious persuasion, testifying as to his moral character.

2d. A certificate from a medical man, testifying that he is of sound health.

3d. His age must not be under seventeen.

When the parents, guardian or patron of a lad decide on seeking permission for him to compete, they communicate with the secretaries of the Board, who, in reply, furnish a blank form, containing a number of queries and forms of certificate, all of which must be duly filled, and returned.

If the applicant is deemed eligible, he is entered on the list of candidates for the approaching examination, of the time and place of which due notice is given.

As it has been decided to admit pupils in the beginning of January and of June each year, the examinations take place in May and December.

In January, 1861, for example, thirty-four candidates were admitted by competitive examination. The mode of conducting the examinations was as follows:—

Seventy-four candidates having been found eligible for competition, were summoned to attend on a given day and hour at the residences of the inspectors of national schools in their respective districts.

The candidates were then subjected to a written and oral examination for a fixed time in the following subjects:—

Reading.—To read with correctness any passage selected in the Fourth Book of Lessons.

Writing.—To write a legible hand with facility.

Spelling.—To write from dictation, with correctness any passage selected from the Third Book of Lessons.

Grammar.—To know the parts of speech, and to possess such an elementary knowledge of syntax as to be able to parse short and easy sentences in prose.

Geography.—To be able to define the technical terms of geography, to know the general outlines of the map of the world, and the boundaries, counties, chief towns, rivers, &c., of Ireland.

Arithmetic.—To be able to repeat with accuracy, or write out the several arithmetical tables, and to work with facility and accuracy easy questions in the elementary rules, fractions, simple proportion and practice.

Book-keeping.—To be acquainted with the nature and use of a cash account.

Geometry.—To know at least the first book of Euclid.

The questions and the time allowed for answering them being the same in each case, the examination was as strictly competitive as if the boys were congregated in one room.

All the papers were transmitted to Dublin, and fifty of the best answerers summoned up to Glasnevin, and there subjected to a second and more searching examination in the subjects following:—

Reading.—As in number one.

Writing.—Ditto.

Spelling.—To write from dictation, with correctness, any passage selected from the Fourth Book of Lessons.

Grammar.—To have a fair knowledge of the text of Sullivan's Grammar, and to be able to parse easy sentences in prose from the Fourth Book of Lessons.

Geography.—As in number one, with the general geography of Europe.

Arithmetic.—Reduction, decimals, fractions, simple proportion and practice.

Book-keeping.—To be acquainted with sets I. to IV., in the Board's book-keeping.

Geometry.—As in number one.

Agricultural Chemistry.—Hodge's First Lessons in Agricultural Chemistry.

Practical Agriculture.—Introduction to Agricultural Class-Book, and chapters XI., XII., XIII., of Murphy's Agricultural Instructor.

The business of the institution and farm is conducted by the following staff:—

1. The superintendent, Dr. Kirkpatrick, (who has the entire management of the concern,) training and farming departments.
2. A matron.
3. An agriculturist, who has charge of the practical management of the farm.
4. A gardener, who conducts the horticultural department.
5. A literary teacher.

In addition to these, there is a staff of non-resident lecturers, viz.: on

1. Animal physiology and pathology, and the treatment of the diseases of the domestic amimals.
2. Botany and vegetable physiology, in their relation to agriculture.
3. Chemistry and geology, in their relation to agriculture.
4. Agriculture.
5. Horticulture.

Each of the officers gives two courses of lectures in the year, which is divided into two sessions; the first session begins after Christmas and ends in June, and the second ends at Christmas.

At the termination of each session, the lecturers hold examinations, and award premiums to the most deserving pupils, according to the following scale:—

		£	s.	d.			
1st. Chemistry,	2 Prizes at	1	10	0			
Ditto,	2 "	1	0	0—	5	0	0
2d. Botany,	2 "	1	10	0			
Ditto,	2 "	1	0	0—	5	0	0
3d. Animal physiology and diseases of farm animals,	2 "	1	10	0			
Ditto,	2 "	1	0	0—	5	0	0
4th. Horticulture,	2 "	1	10	0			
Ditto,	2 "	1	0	0—	5	0	0
5th. Literary subjects,	2 "	1	10	0			
Ditto,	2 "	1	0	0—	5	0	0

		£	s.	d.			
6th. Agriculture,	1st Prize, . . .	3	0	0			
Ditto,	2 Second Prizes, . .	at 2	10	0			
Ditto,	3 Third " . .	at 2	0	0			
Ditto,	4 Fourth " . .	at 1	10	0			
Ditto,	5 Fifth " . .	at 1	0	0	—25	0	0
					£50	0	0

No pupil can take more than three prizes* in one session.

The course of instruction is said to be more comprehensive and complete than that afforded at any similar institution.

The literary masters teach English grammar, and composition, arithmetic, book-keeping, and mathematics, including land-surveying, levelling, and mapping.

The instruction in agriculture embraces all those branches which constitute the science of farming, as well as a detailed account of the enlightened and improved practices of the day; and in order that the pupils may become thoroughly acquainted with improved practical husbandry, they are called upon to take part in the performance of every farm operation, and the feeding and management of live stock. They have an opportunity, too, of practically studying the application of steam power to agricultural purposes, as well as the use of a large assortment of those modern implements and machines, which are found economical substitutes for manual labor.

The Farms and Gardens.—The soil is a clay loam of a brownish color, resting on the calcareous formation; its maximum elevation is 172 feet, minimum, 148 feet; and the greater portion of it has a slight inclination to the south. The depth of the surface soil averages from eight to twelve inches.

Dr. Hodges' examination of the soil and subsoil gives the following results:—

	Soil.	Subsoil.
On mechanical examination every 100 parts contained		
clay and finely divided matter, ...	24.71	28.32
Sand and small stones, ...	75.29	71.68†
	100.00	100.00

* A silver medal is awarded, each session, to the most talented and deserving pupil.

† Consisting of coarse granules of blackish limestone, gray chert, and calcareous sand.

Every 1,000 parts of surface soil retained 688 parts; of subsoil, 484 parts of water.

Of the water which the specimens had imbibed, in four hours the surface soil lost by evaporation 17.8; the subsoil 30.6 per cent.

I. *The Large Farm*, 145A. 3R. 37P., is divided into four sections, on each of which a distinct course of farming is pursued, as follows:—

	Area.	
a Three Course Rotation, about	21	
á Four " " "	36	
b Five " " "	25	
c New Farm, Wheat, ...	14	51
" Pasturage, ...	37	

Yards and Offices, Paddock, &c., occupy the remainder.

The order of succession of the crops in the three course rotation is:—

1st year, Green crops, manured.

2d year, Grain, with Italian rye-grass, and clover.

3d year, Grass, for soiling and hay.

In the fourth course, usually called the "Norfolk Shift," the crops succeed in this order:—

1st year, Green crops, manured.

2d year, Grain, with grass seeds, generally Italian rye-grass.

3d year, Grass, for house-feeding cattle, and hay.

4th year, Oats.

The five course on this farm differs from the last in keeping the grass field unbroken a second year. The crops, therefore, succeed in this order:—

1st year, Green crops, manured.

2d year, Grain, with grass seeds.

3d year, Grass.

4th year, Grass.

5th year, Oats.

The balance-sheet has been satisfactory, showing a credit of from two hundred to three hundred pounds a year in favor of the pupils' labor.

II. *The Small Farm*, 23A. 1R. 5P., was established in 1856, for the purpose of affording an illustration of small farm management, and to present to the sons of small farmers an example which they may imitate.

The following five course rotation is carried out on this farm:—

1st. Turnips, Mangel Wurzel, and Carrots.
2d. Potatoes, Winter Beans, and Cabbages.
3d. Italian rye-grass.
4th. " "
5th. Oats.

The Italian rye-grass is sown in autumn, immediately after the harvesting of the potatoes and beans, and a most luxuriant crop is thus obtained. This season they had grass three feet long, and yielding ten tons per statute acre on this farm early in May. Italian rye-grass has been sown on the Albert Farm in autumn, after grain; but though every care has been taken to have the ground properly prepared by the use of Bentall's broad-share, grubbing, &c., yet the following crop of grass has not been quite satisfactory.

Some are not favorable to two years' growth of Italian rye-grass unless where there is an unlimited command of liquid manure or frequent top dressings of the artificial manures. This grass is a gross feeder; and when it grows luxuriantly the first year, it degenerates in the second, not so much from the habits of the grass itself as from want of nutriment in the soil.

As might be expected, the pecuniary results of the working of this farm are more favorable than those of the larger one. There is a balance of £70 11s. 5½d. after allowing the sum of £42 7s. 8d. (at the rate of £2 5s. per statute acre,) for the pupils' labor.

III. The Horticultural Department consists of a kitchen and a fruit garden, and a small range of glass, including a vinery, peach house, and conservatory. On the south side of the buildings there is a neatly laid out pleasure-ground. These various branches of this department afford to those pupils who have a taste for gardening an opportunity of qualifying themselves for discharging the combined duties of steward and

gardener—duties which, from motives of economy, are now frequently imposed on one individual.

The Farm Buildings.—The visitor generally enters this large pile of buildings by an archway on the south side, leading into a yard 124 by 93 feet. In the centre of this yard is a solid two-story house, stabling and harness-room for six horses occupying the north side of the ground floor, the south side being appropriated to carts and implements. The second floor serves as a granary and store rooms. When this new range of offices was about half erected, the commissioners took advantage of a favorable opportunity that presented itself for enlarging the farm; and having to extend the amount of accommodation for live stock, they had to alter their plans. For instance, the building now occupied as a cattle barn was originally intended to serve as a barn and stable, and the interior still bears evidence of the existence of a division wall.

The portion of this building appropriated to implements, &c., is 13 feet wide by 53 long. There are four paved ways for carts, dividing it transversely. The wheels run on cut limestone stones embedded in the paving, and having shoulders which serve as guides for the wheels. These shoulders or guides are five feet apart.

The stables are 10 feet 6 inches high; front to back wall is 15 feet; the stalls are each six feet wide, so that the cubical contents appropriated to each animal is 945 feet, which would be rather limited without efficient ventilation.

The hay rack is beneath the horse's head. It rises 3 feet 3 inches above the floor, and is 1 foot 6 inches wide. This plan is now generally preferred to having the hay over the animals' heads.

The dimensions of the oat manger are 2 feet 2 inches by 1 foot 6 inches by 1 foot. The partitions consist of wooden boards kept fast by metal rails attached to the front wall (7 feet 3 inches from the ground) and to metal cylindrical posts (at the height of 4 feet 6 inches from the floor) which are 9 feet from the front wall. Over the animals' heads is a perforated sheet of zinc, for permitting the escape of vitiated air. Fresh air is admitted through the doors and windows. The upper half of the windows is constructed, in the ordinary way, of glass panes, and moves upon a pivot. The lower half consists of two

sets of spars, $2\frac{3}{4}$ inches wide and $2\frac{1}{2}$ inches apart; the outer being fixed ; the inner slides right and left, so that the admission of air is simply regulated by the inner slide.

The stable doors are 4 feet wide, and like those of the barns, slide flush with the wall, on rails ; and to facilitate the movement, they are provided with castors running on the rails, and small wheels on both sides near the top.

The building facing the east side of the yard is the cattle barn, which is capable of accommodating 52 head of cattle. It is 98 feet long by 32 wide. There are two rows of cattle facing each other, and separated by a feeding passage 6 feet wide running the whole length of the building. This passage is lined on either side with cast metal rails or lattice work, which rise 2 feet above the troughs, and are attached to the cast-iron partitions. The space from the feeding passage to the side walls is appropriated thus :—Stand (to channel) 8 feet; channel, 14 inches wide (and 4 inches deep); passage behind animals, 3 feet 10 inches. The stalls are double, *i. e.*, the space between each pair of partitions is for two animals. The partitions in the southern half of the building are 7 feet apart, which gives 3 feet 6 inches as the width of each lair. In the northern half, generally occupied by the smaller breeds and young stock, the partitions are 6 feet apart, which gives each animal a space 3 feet wide.

The feeding troughs are made of slate slabs. The side slabs incline outwards, particularly the front one. The dimensions are—Front, 16 inches; back, 12 inches ; width at bottom, 12 inches ; top of front to that of back slab, 21 inches.

The channels behind the animals have been constructed in a very substantial manner. Perforated cast-iron plates cover a conduit of granite, semi-circular at the bottom, and having several openings communicating with a very copious liquid manure tank. When it is desirable to remove any sediment that may collect in the conduit, the cast-iron plates are removed. The feeding and other passages are paved with granite. The cattle floors on one side of the barn are paved with brick, having a fall of an inch and a half; on the other side the flooring consists of wooden spars nine inches wide and separated by one-inch interstices. About six inches beneath these spars is a solid

floor of flags set in mortar, with a considerable fall towards one point, or sink for carrying off the urine.

The barn is well ventilated by large Louvre ventilators placed in the ridge of the roof. Fresh air is admitted, and particularly about the cows' heads, by the following contrivance: Under the feeding passage is a channel communicating with the external air at two points—at the south end wall, and at the open shed facing the stack-yard, and in which the root washer is fixed. This underground air channel has several branches rising to the surface of the feeding passage, and which are covered with perforated pieces of metal. Fresh air rises through these openings when the slide in the south end of the house is lifted.

At the rear of the barn is the manure yard. The site immediately occupied with manure is 86 by 53 feet; and between the manure heap and the barn is the receptacle for liquid manure. This consists of a large tank divided by a partition into two compartments, each 40 feet long, 8 feet wide, and 9 feet high to the spring of the arch. One compartment receives the urine from stables, barn, calf-pens, and piggeries; the other receives the liquid from the urinals, water-closets, wash-rooms, &c.

The bottom and sides of this tank were built of brick, lined with two coats of Portland cement; and a strong brick arch covers it.

A wooden shed, roofed with felt, has been erected against the east wall of the manure court to accommodate young stock. The length of the stands (8 feet) is the same as in the large barn already described. This shed is 63 feet long and 12½ feet wide.

The piggeries are placed on the north side of the manure yard. There are six sties with a southern aspect, each 10 feet 6 inches by 7 feet, with yards 16 feet by 7 feet. Torr's patent troughs are used. They are rather expensive; but the principle, (which is a good one,) can be easily applied in the case of ordinary troughs.

Piggery No. 2, placed in the middle of the range, and at right angles to the others, is arranged precisely like the calf-pens. There is a central passage 5 feet wide, on each side of which are eight pens or sties, each being 6 feet by 6 feet 9

inches. The sparred flooring was introduced in this house with more success than in the barn, the spars being 8 inches wide and $\frac{3}{4}$ of an inch apart: but litter cannot altogether be dispensed with. Some look upon this mode of housing pigs as objectionable, and at variance with that well-known instinct of the pig which induces it to keep its lair free fom its dung. At Glasnevin, pigs thrive very well in this piggery, particularly fattening pigs.

Over one side of this piggery mixed breeds of poultry are kept; the heat evolved from the pigs keeps up the proper temperature in winter. On the other hand, this arrangement was objected to on the ground that the air, which is occasionally unavoidably unpleasant, would be prejudicial to the health of the poultry, but experience has shown this not to be the case, which, however, may be attributed to the effective ventilation of the house.

A covered stair or passage rises from the manure yard on the one side, and from the stack-yard on the other, by means of which the poultry ascend or descend at pleasure. Strange fowls require a little training to induce them to reach their roosting and laying apartments, but it is interesting to witness how soon they become accustomed to their ascents and descents.

Immediately adjoining the piggeries is the calf-house, 21 feet 2 inches by 11 feet 3 inches, apportioned as follows: Passage, 5 feet wide, dividing six pens into two rows; each pen is 8 feet 2 inches long by 3 feet 9 inches wide. In an angle of each pen is a small rack for hay.

After inspecting the calf-pens, the visitor next passes along the open passage north of the barn and leading to the steaming shed, which is 44 feet by 16 feet. The feeding passage in the barn faces the doorway of this apartment. Metal vats were also used; but having lasted four years, they have been replaced by two fixed wooden ones, for preparing linseed, barley, bean, or oatmeal gruel, and a galvanized metal one, which turns on pivots, and is used for steaming roots. The latter is placed over a sunk trough, in which the steamed ingredients are mixed. This trough is 9 feet long, 3 feet 6 inches wide, and two feet deep, and is lined with cement. The wooden vats are 2 feet 9 inches diameter and 3 feet 4 inches deep. The metal one is about the same size. In one corner of this shed is

a larger wooden trough, in which alternate layers of cut straw, roots, bean-meal, and oil cake are steamed for the milch cows in winter. It is 13 feet 3 inches long 5 feet 4 inches wide, and 3 feet high. A perforated pipe, communicating with the boiler, is laid on the bottom, and by turning a cock, the steam ascends through the mass and "cooks" it. At an elevation of nine feet there is a pipe perforated on the lower side, in communication with the water cistern, and by which an artificial shower can be made to fall on the surface of the steaming mess, and the ascending steam is thus condensed, and its escape prevented. Damaged hay, &c., is rendered agreeable to the cattle by this process. Bean straw, when steamed, is also readily eaten by cattle.

Turnip cutters are placed in this shed. There is a double-action machine for cattle and sheep. This is an excellent machine. A pulping machine is also used, and works very efficiently. It consists of a number of teeth arranged spirally around a cylinder, revolving on its horizontally-placed axis. The teeth pass between a revolving *spiral*, which prevents the machine from choking. A shaft, driven by the steam-engine, runs through the steaming shed, and if the engine is at work there is a piece of machinery partly at work in this shed, and partly in the open shed adjoining it, and facing the stack-yard. In this latter shed is a root-washer made of wood, and consisting of a frame containing water, in which revolves a skeleton cylinder, or, more strictly speaking, the frustrum of a cone, the taper being scarcely precipitate. At one end the roots are put into the cylinder, and an Archimedian screw at the other end raises and throws them on an inclined plane, whence they fall on the elevator, (formed of curved bars fixed to a leather belt kept revolving,) and which carries them to the steam-driven root-cutter. The cut slices fall into a wooden trough beneath the cutting machine in the steaming shed.

The next apartment is the chaff-cutting room, thirty feet by sixteen. Here is an oil-cake bruiser, an oat bruiser and a straw-cutter. Of straw-cutters there is a great variety; some cutting continuously, others giving an intermittent cut; some having knives attached to a disc or wheel, revolving in a vertical plane; in others the knives are attached to a revolving cylinder, and others again have the cutting blade oscillating vertically.

The revolving cylinder is preferred by some of the most competent judges.

Leaving this room, we pass on to the barn, the gable end of which faces the stables.

The ground floor of this building consists of: (1) mill room, (2) steam-engine room, (3) corn barn, or room for storing, &c., and which is 41½ by 21½ feet. On the second floor, 14 feet from the first, are—(1) the threshing room (same dimensions as corn room;) (2) dressing room, 21 feet 6 inches by 17 feet 9 inches, containing two fixed winnowing machines. This apartment is over the engine and mill rooms. As the grain leaves the last fanners it enters an opening, descending to within a few feet of the ground floor, and is received into bags. So that, from the time of putting the sheaf into the threshing machine till it is bagged, there is no intermediate manual labor. The hopper of the mill is in the corner of this apartment, so that the grain is easily transferred thither when required.

The steam-engine is eight horse power, but capable of being worked to ten. It is a high pressure engine, and has a vertical cylinder with an eccentric for pumping water into the boiler, the whole being firmly fixed on a solid floor of granite. The crank attached to the piston turns an axle, on which, at a few inches from the crank, a fly-wheel weighing one ton is attached, and which passes through the wall into the "corn" room, where motion is obtained from a double pulley on this axle, by means of belts. One belt is carried up to the threshing floor, for communicating motion to the threshing and winnowing machines. Another belt runs flush with this wall to another pulley, attached to an axle going through the same wall, for driving a "bevelled" wheel, which communicates motion to two shafts, passing in opposite directions—one to the chaff room and steam shed, the other running up to the liquid manure propeller and dairy. The threshing mill is on the Scotch principle, and absorbs four horse power. It has a covered drum with projecting edges as beaters. There is only one shaker, consisting of a revolving cylinder carrying spikes. The straw falls on an inclined plane, and is stored in an adjoining covered shed, opening to the east.

The threshed grain falls down to the first winnowing machine, which blows the chaff into a small apartment adjoining the straw

shed. The grain falls out on the right side, and is elevated through a wooden tube (elevator) by a series of tin cups attached to a leather belt kept revolving while the mill is at work. The grain falls from this elevator into the second winnowing machine, and then into the third in the dressing room. Any unthreshed ears of grain that may have passed through the mill, fall to the left of the first winnowing machine, and by another elevator are brought up, and falling on the grain on the feeding board, are passed through the mill again and again.

A governor acts on a piece of sheet iron in the side opening of the fanners. When the speed of the fanners is fast, this piece of metal closes in, and thus diminishes the blast; when the speed is slow, it opens out and presents no obstruction to the ingress of the air.

The three fixed fanners described turn out the grain pretty clean; but for seed and other special purposes, Hornsby's admirable fanners have been recently purchased. This machine seems all that is to be desired. The dimensions are—length, 5 feet 4 inches; width, 2 feet 6 inches; height, 4 feet 3 inches; do. to top of hopper, 5 feet 6 inches. So far there has been no occasion to work the toothed cylinder, kept revolving amongst the descending grain, which forms so novel a feature in this machine.

Over the boiler is a kiln for preparing grain, &c., for the mill. The grain is introduced into the kiln, from the barn loft, through a sluice in the wall; and when kiln-dried it is removed into a sack in the corn room, through another sluice. The kiln consists of thirty plates, and seven malleable iron "wheeps"; the cost of which, including fitting, was £10 5*s*.

The stack-yard is a spacious area, walled in. Metal stands are used for the stacks. The pillars are cast-iron, and covered with caps, the convex side downwards. The horizontal bars are made of wrought iron or wood.

The liquid manure propellers are worked by the engine. This piece of machinery is placed in a small apartment, over which is the water cistern for supplying the boiler, taps in barn, cock in cooking shed, &c. There are two pistons, each four inches diameter and two feet stroke. It was estimated to distribute 4,500 gallons per hour; but in practice it never discharges more than 3,000 gallons in that time. The price of

pump and belts, and fitting up, was £61 1s. The cistern, which is capable of holding 1,350 gallons, cost £38 13s. 10d.

The dairy has attracted a great deal of attention. The first feature that merits notice is the open shed, facing the yard, for airing the milk vessels, &c. It is 41 feet 6 inches long, and 11 feet 6 inches wide. A dairy usually contains three apartments: (1) kitchen, (2) churning room and (3) milk room; and if cheese be manufactured, an additional apartment is required.

Here the churning and butter dressing are performed in the dairy kitchen, which is kept most scrupulously clean. It is 17 feet by 14 feet 9 inches. It has a granite trough for washing vessels, supplied with hot and cold water cocks. The butter is dressed in a trough of polished slate flags, to the left as you enter. Its dimensions are—4 feet long, 2 feet wide and 4 inches deep. By turning the cock immediately over it, we have a supply of cold water; by lifting a tap in the bottom, this water escapes.

When the engine is at work, churning can be done by steam. The churn is placed in front of the cone, in this kitchen; and its axes being fixed in the cone, the churning proceeds. The extra expense for churning gear (viz., 34 feet of 2-inch shafting, 4 brackets, 5 pillow blocks, 9 bolts for brackets and pillow blocks; 1 shaft, 13½ feet long and 1½ inch diameter, in dairy; fast and loose pulleys, cone, fitting up, &c.) was £37, 9s.

Rowan's registered churn has long been used at Glasnevin, with most satisfactory results; and is the one generally used, though there are others of different constructions.

The milk room is 50 feet long and seventeen feet wide.* It is divided into two compartments by a transverse wall, having a large arched opening. There is a great variety of milk vessels: White earthenware, which is easily cleaned, but liable to be broken in the hands of careless servants; glazed earthenware, which is cheap and easily cleaned; glass, which for sweetness and cleanliness cannot be surpassed, but is too fragile and consequently too expensive; enamelled metal, which is all that could be desired, if the enamelling were only proof against the effects of hot water; zinc, which by some is considered objectionable on account of lactate of zinc being produced; and

* Height to the ceiling, 9 feet 10 inches.

galvanized iron, which is admirable. All these vessels are shallow, the milk being about three inches deep.

The milk stands consist of light skeleton metal frames, across which are laid two polished slate slabs; the first tier being 1 foot 6 inches from the floor; the upper, three feet; the width is 1 foot 4 inches. The windows (4 feet 9 inches high, by 3 feet 10 inches wide) are very complete, consisting of three distinct parts, each movable up and down by means of cords and pulleys. (1) Externally is a solid shutter of wood; (2) in the middle is an ordinary glazed window; and (3) inside these is a close cocoa-nut screen, which serves in summer the double purpose of excluding flies and keeping the apartment cool. By sponging it with cold water, in excessively warm weather, the evaporation reduces the temperature down to a moderate degree.

It takes from half an hour to an hour to churn with Rowan's churn. Butter produced in less than half an hour is too soft, and when the churning exceeds an hour the quality is seldom good. On on average it takes about ten quarts of milk to produce one quart of cream, or one pound of butter. It is found that about the same quantity of butter is produced, whether the whole milk or cream is churned. The average return from each of the twenty-six milch cows at the Albert Farm, for the twelve months ending 31st March, 1858, was £18, exclusive of the milk consumed by pigs and young stock.

There is a select agricultural library for the use of the pupils; a laboratory; and an extensive collection of minerals, dried plants and diagrams to illustrate the various lectures.

In addition to the machinery already described, there is a large and effective bone mill, worked by steam power.

The implements consist of ploughs, rollers, grubbers, the zigzag harrow, seed sowers, horse hoes and horse rakes, all of the most improved pattern.

The crops are chiefly wheat, barley, oats, mangel wurzel, Swedish turnips, potatoes, beans, carrots and Italian rye grass.

Model and other agricultural schools form a part of the system of agricultural education, established in Ireland by the commissioners of national education, which comprise several distinct classes of agricultural schools.

1. The Albert, or central institution, Glasnevin, which, besides being the centre of life and action to the entire scheme,

serves as a departmental section of the training establishment of the national board. Nearly 200 male national school teachers, who come up to Dublin annually for "training," are instructed in the leading scientific and practical facts of modern husbandry.

2. A class denominated "Model Agricultural Schools," which are either in connexion with district model literary schools, or specially established as an intermediate grade between the Albert institution and the smaller agricultural schools to be presently referred to. Of this class there were, in 1860:—

Twenty under the exclusive management of the national board, and eighteen under the management of local patrons, landlords, &c.

3. A number of small, called "ordinary agricultural schools," and which, like the model agricultural schools, are scattered throughout the provinces. Of these there were forty-seven in operation in 1859.

4. Workhouse agricultural schools: of these there were fifty-eight in 1859.

The agricultural education afforded in the workhouses consists of a certain amount of instruction, calculated to make the boys skilled in the execution of their future labors; and to raise their thoughts to a correct knowledge of the raw materials on which they will have to operate, and to the best and most economical ways of tilling the land and of disposing of its produce.

A certain amount of theoretic and practical knowledge is imparted in the school-room, which the boys reduce to practice on the piece of ground attached to the workhouse, under the direction of a competent agriculturist.

It is needless to argue that such a course of training as is afforded in those workhouse national agricultural schools must promote the interests of the nation at large. It has vastly benefited the poor themselves who have received it; it has benefited the rich by increasing the supply of skilled labor; it has benefited the tax-payers by diminishing the rates; and it has materially contributed to the harmony, peace, and prosperity of the country, by promoting habits of industry and that spirit of self-reliance which is the most efficacious preventive of crime. The payments made by the national board on account of this class of schools in 1859 amounted to £363 15s., or about £6

5s. per school. In forty-six of those schools, (whose returns have been published) one thousand seven hundred and eleven boys received the agricultural education above described, at an average cost of 3s. 4d. per boy.

Ordinary agricultural schools, as the name indicates, consist of ordinary national schools having a few acres of ground attached to each. In these schools the sons of farmers, laborers, and such others as may desire it, receive, in addition to the ordinary literary education, elementary instruction in the science and practice of agriculture. The little farms are, for the most part, worked by the boys. The teacher of a school of this class receives, in addition to his literary class salary, £5 a year and the profits of the farm.

The forty-seven ordinary agricultural schools in operation in 1859 cost £269 1s. 2d., or about £5 15s. per school. In forty of those whose returns have been published, one thousand three hundred and seventy-five boys received agricultural instruction at a cost of 3s. 4d. per boy per annum.* No money expended by the state could be productive of more benefit than the small sum expended on teaching those young lads—the rising small-farmers and laborers of Ireland—correct notions of the art by which they must earn their bread;—the art which is the staple industry of their country.

The outlay on "ordinary" agricultural schools is so trivial compared with the immense advantages derived therefrom, that, like the cost of agricultural education in workhouses, it may reasonably be doubted if any would object to it. When the commissioners of national education engrafted agricultural instruction on the ordinary secular instruction in some of their country schools, they observed that:—"Considering the very backward state of agriculture in Ireland, and that it forms the

* In the English agricultural and other industrial schools, the committee of council on education allow 5s. for each industrial scholar when a special industrial instructor is employed, and 2s. 6d. when the ordinary teacher conducts the industrial department. In addition to this allowance a grant is made to each industrial school equal to half the rent of the premises specially hired for the purpose, and one-third the cost for tools or raw materials for labor.

In certified industrial schools for vagrants, the sum of 6d. per day, up to a maximum sum of £7 10s. per annum, has been allowed from the education grant for every child received under magisterial sentence.—Vide *Parliamentary Estimate*, 1861-2. IV. 131.

only source of employment for a vast portion of the laboring poor, we think it particularly desirable that a better knowledge of it should be promoted by means of the schools under us."

Acting upon this principle, the commissioners encouraged, in every possible way, the teaching of agriculture in their country schools. For a long time they preferred employing the funds placed at their disposal in making small grants to a large number of schools to establishing a few costly model farms, believing that "the chief good that can be effected by the national board in the way of agricultural improvement is by blending, in as many national schools as possible, instruction in agriculture, and daily occupation in agriculture, with the literary instruction already given in those schools."

Concurrently with the introduction by the commissioners of agricultural instruction, on this inexpensive scale, into their country schools, many of the landed gentry took an active part in promoting the establishment of a class of agricultural schools on a more extensive scale than those previously existing. They deemed it all important that provision should be made for agricultural boarders, who, by a regular course of apprenticeship, would study the theory and the art of farming in a detailed and systematic manner, and who would, in after life, become intelligent farmers, land-stewards and agriculturists; in which capacities it was expected that they would amply reimburse the country for the outlay.

In this way arose the model agricultural schools, whose aim is higher and whose cost is greater than that of ordinary agricultural schools.

Of the model agricultural schools there are, as already mentioned, two classes:—

(1.) Those under the management of local patrons, who in most cases have erected the farm offices, and, in some cases, contributed the agricultural plant. With one or two exceptions, the teachers rent the farms from the patrons. The aid given by the board towards the maintenance of this class of schools consists of grants of agricultural books, and an allowance to the teachers for agricultural instruction and for the maintenance of boarding agricultural pupils.

The number of pupils educated in those schools in 1859 was—

Agricultural boarders, ...	62
Agricultural day pupils, ...	607
Total, ...	669

(2.) Model agricultural schools under the exclusive management of the board.—The farms attached to these schools are rented by the commissioners; the farm buildings were erected by them—aided in some cases by local contributions—and, with some exceptions, the farms are cultivated for and at the risk of the commissioners, by agriculturists, who are also charged with giving agricultural instruction in the schools.

The number of pupils educated in 1859 was—

Agricultural boarders, ...	154
Agricultural day pupils, ...	538
Total, ...	692

Two classes of agricultural boarders are admitted to these schools, namely, *paying* and *free*.

Paying pupils are submitted to a qualifying examination in the subjoined programme, so that none should enter with an education so deficient, that they could not fully benefit by the instruction afforded.

The free places are obtained by *competitive* examination in the same programme,* and such additional subjects as the candidate may be prepared in.

The cost to the pupils on these farms is from thirty to forty dollars a year only, for those who pay.

* Programme of examination for candidates for admission to model agricultural schools:—

To know notation and numeration well, and to repeat all the more useful arithmetical tables. To work readily questions in the simple and compound rules of arithmetic. To distinguish readily, and with certainty, in any easy sentences selected from the daily lessons, all the parts of speech. To know the maps of the world and Europe. To write on paper a fair hand. To know and to be able to write down the characters or marks used in punctuation. To write down correctly easy sentences from dictation. To write out from memory the time and money tables. To read and spell correctly the words of an easy lesson, and to explain the meaning.

Time Table for Agricultural Boarders.

At	5 0	A. M.		Rise.
From	5 0	to	5 45	Dress and devotional exercises.
"	5 45	to	6 30	Feed and clean stock, clean yard, &c.
"	6 30	to	7 0	Wash and prepare for study.
"	7 0	to	8 45	Study agricultural subjects, and attend the lecture or examination of the agriculturist.
"	8 45	to	9 0	Prepare for breakfast.
"	9 0	to	9 30	Breakfast.
"	9 30	to	2 0	P. M. Feed stock and work on the farm.
From	2 0	to	3 0	Dinner.
"	3 0	to	6 0	Feed stock and work on the farm.
"	6 0	to	6 30	Prepare for study.
"	6 30	to	8 0	Study literary subjects under the superintendence of the literary teacher.
"	8 0	to	8 30	Supper.
"	8 30	to	9 15	Feed stock and arrange every thing for the night.
"	9 15	to	9 45	Devotional exercises and retire to bed.
At	9 45			Extinguish lights in dormitory.

The above is designed for the *Summer* half-year; during the winter months the hours for rising, meals, labor, and instruction, must be regulated according to the season.—This table may be altered at busy seasons of the year.

Dietary for Agricultural Boarders.

DAYS.	Breakfast.	Dinner.	Supper.
Sunday,	Bread, ¾ lb.; butter, 1 oz.; tea, 1 pint,	Bread, 3 lb.; beef, boiled or stewed, ¾ lb., and vegetables,*	Oatmeal, ½ lb., in stir-about, and skim-milk, 1 pint.
Monday,	Bread, ¾ lb., and sweet milk, 1 pint,	Bread, ¾ lb., and bacon, ¾ lb., boiled with vegetables,	Oatmeal, ½ lb., in stir-about, and skim-milk, 1 pint.
Tuesday,	Bread, ¾ lb., and sweet milk, 1 pint,	Bread, ¾ lb.; butter, 1 oz.; eggs, 2,	Oatmeal, ½ lb., in stir-about, and skim-milk, 1 pint.
Wednesday,	Bread, ¾ lb., and sweet milk, 1 pint,	Bread, ¾ lb.; 8 ozs. beef, ½ pint soup, and vegetables,	Oatmeal, ½ lb., in stir-about, and skim-milk, 1 pint.
Thursday,	Bread, ¾ lb., and sweet milk, 1 pint,	Bread, ¾ lb.; bacon, ¼ lb., and 2 eggs, fried,	Oatmeal, ½ lb., in stir-about, and skim-milk, 1 pint.
Friday,	Bread, ¾ lb.; butter, 1oz., and coffee, 1 pint,	Bread, ¾ lb.; fish, 1 lb., or milk, 1 pint, and butter, 1 oz.,	Oatmeal, ½ lb., in stir-about, and skim-milk, 1 pint.
Saturday,	Bread, ¾ lb., and sweet milk, 1 pint,	Bread, ¾ lb.; 8 ozs. beef, ½ pint soup, and vegetables,	Oatmeal, ½ lb., in stir-about, and skim-milk, 1 pint.

Where the pupils pay £8 a year, a somewhat higher scale than the above is used.

* Potatoes, when available, can be substituted occasionally for the bread at dinner.

The course of instruction comprises:—

1st. A sound English education, including reading, writing, grammar, and composition, geography, history, arithmetic, book-keeping, the elements of geometry and algebra, and land surveying.

2d. In the agricultural department—The elements of agricultural chemistry and of animal and vegetable physiology; drainage; tillage by manual and horse labor, with the description and use of the different implements necessary; rotation of crops; preparation of the soil for, time and mode of sowing, after-culture, harvesting and economizing the different crops cultivated; the best modes of collecting and preserving manures, with the nature and utility of stimulants and special manures, the crops to which they should be applied, at what time, and in what quantity; the breeding, rearing, house-feeding, and general management of the different kinds of live stock; and the mode of keeping farm accounts, &c.

The school farms are managed by men who were trained at the Glasnevin establishment, and who are expected to carry out the most approved and economical modes of farming. They are provided with improved farm implements, approved seeds and manures. The live stock is, in many cases, of pure blood, and, in some cases, pure-bred sires are kept partly for home use, and partly for the improvement of the stock in the surrounding country.

The farm offices are also arranged on approved principles, and substantially built.

It will be seen, from what has been said, that agricultural instruction forms a prominent part of the system of national education,—that this instruction is comparatively open and free to all who are prepared by an ability to pass a reasonable examination,—the cost being so low, as to bring its advantages within the reach of all classes. There are one hundred and thirty-four of these branch schools where agriculture is taught.

The Albert Model Farm and Institution, which stands at the head of the whole system, is worthy of the name it bears. The land of this farm is hired at four pounds, or twenty dollars, the statute acre a year rent, on a lease of nine hundred and ninety-nine years. Here the boys do all the work,—a man being hired now and then, as an exception, for some special employment.

The pupils range from seventeen to twenty-two years of age. They prefer that they would not enter under twenty. The land is rich and under a high state of cultivation, as it ought to be, to enable the institution to pay so high a rent.

Every thing about the farm-buildings is plain and substantial. The whole establishment, in fact, has an air of practical work. The dining-room is hung with the drawings and lithographs of prize animals. One end of it is used for a collection of implements, seeds, minerals, &c.,—all labelled. The school-room is furnished with plain, hard seats, vastly inferior in ease and comfort to those in any of our improved school-rooms; and hung with charts, maps, &c. It has various kinds of apparatus, thermometer, barometer; rain-gauge, on the outside of the window, &c.; globes, celestial and terrestrial, &c. The chemical laboratory is small and ill-supplied, compared with the same in most of the large schools on the continent, but probably sufficient for the limited instruction in this department.

The farm does not wholly support the institution. It would be unreasonable to expect it, with the high rent it has to pay, and the small amount required of the pupils, which covers board, washing, tuition, &c. I was told, the additional cost per pupil to the government was twenty-four pounds a year. But the farm itself, not charging it with the labor of the boys, shows a considerable balance in its favor.

The stock kept on both farms is, usually, seven horses, about fifty cows and young stock, two bulls, from forty to sixty sheep, and forty to fifty swine. The cows are mostly grade Shorthorns. There were two pure Ayrshires and one Kerry. They find that nothing exceeds a three-quarters Shorthorn for profit, when the product in milk and the economy of fattening afterwards is considered. From a three-quarters Shorthorn and one-quarter Irish cow, they get large yields. The bulls are worked in the fields, and this is thought to improve them. The pigs are Yorkshires and Berkshires. They are washed about once a week. The Berkshires are the most hardy, and can endure considerable rough usage; while the Yorkshires are a little tender, and are not so good nurses.

The price of ordinary dairy cows in this neighborhood is from twelve to fifteen pounds, or from sixty to seventy-five dollars;

but first-class cows for the dairy bring from eighteen to twenty pounds.

Vetches are sown in September, at the rate of two and a half bushels of seed to the acre. With us, they thought, it would be necessary to sow in April or May, and to sow about half a bushel of beans or oats with them, as a support to the stalk. They feed this crop out green for soiling. Sixteen varieties of Swedes are cultivated on two acres; and they say that none are better than Skirving's Improved,—the only objection to it being its bottle-neck. The Leicester Swede is exceedingly good. The best for the table is Laing's.

The flower-gardens and shrubbery about the house are kept in superb order; and, when I was there, every thing was loaded with luxuriant foliage and teeming with fragrant blossoms. Mrs. Kirkpatrick—to whom I was indebted for a great deal of civility—took great delight in showing this part of the establishment; much of it, no doubt, due to her good taste and skill in planning and directing.

This statement with regard to some of the principal agricultural schools in Europe might be considerably enlarged, but the practice and instruction in the others are so similar to those that have been given, that it is believed a pretty good general idea of them all may be derived from the foregoing pages. It has been seen, that a large and influential class of scientific men are devoting their lives to pursuits connected with this important branch of human knowledge; some of them in institutions designed expressly for this instruction, isolated and independent; others in connection with other institutions, old and long established.

It can hardly be denied, that it is an important incidental advantage to any country, resulting from the organization of agricultural institutions, that it creates a class of men who devote their higher intelligence and their entire lives to investigations designed to promote the advancement of science in its relations to practice. The constant contact with men learned in the other professions and sciences; the means of experiment and study at their disposal in a college for professional instruction, —like that at Hohenheim, for instance,—are eminently suited to form and develop those choice intellects which add to the

glory of a country and the pride of the people. Well, indeed, has Hohenheim paid its debt in this respect; for, since its foundation, many scientific professors of distinction have spread throughout Germany and the world, the valuable practical knowledge acquired or taught by them at that royal institute.

The circumstances in which the European agricultural schools have grown up, and the state of society, are so different from our own, that it does not follow, that what would be best for them and for the condition of society which feeds them, would be best for us. I am inclined to think the system adopted at Glasnevin, at the Albert Model Farm, is better adapted to meet the wants of the present time and the present condition of things in Ireland, than a scientific institute connected with the University of Dublin, or with any other, would be.

Nor do I think that any impartial observer can fail to see, that had the agricultural college of Cirencester been connected with one of the universities, Cambridge or Oxford, it would be more likely to accomplish the ends which it now proposes to itself, would possess greater vitality, and receive a far more liberal patronage from the class of people it now aims to educate, than it does, or is likely to, in any time to come. It would have been able to secure and retain the highest scientific talent; while the farm which is now used simply as a model for illustration, on which the students do not work, would have been equally valuable and important on the downs of Oxfordshire or on the fens of Cambridge.

In Germany, where the experience has been longer than in any other part of Europe, the question of connecting agricultural institutes with others, or of having isolated and independent establishments, has long been agitated, and is now more warmly discussed than ever before; one party—and it is probably by far the larger—taking the ground for, and the other against such union; each governed, in a measure, no doubt, by personal experience in the one or the other system.

So far as I was able to inform myself, the ground taken by the advocates of a union with the universities is, that it is better for a young man setting out to procure a liberal education in agriculture, to lay the foundation in a thorough knowledge of general principles embodied in the wide range of sciences which bear more or less directly upon agriculture, and then to

devote himself to the application of those principles by practical labor on a suitable farm or farms for one or more years, or till he becomes efficient in the manipulations. This course will be seen, on reflection, to be closely analogous to our present most approved modes of acquiring a thorough knowledge of law, medicine and divinity.

Suppose a young man wants to become a lawyer. Is it better to go first into the office of some successful man in large practice, where he must fall at once into the routine of office work, filling out forms, copying writs, looking up titles, and a thousand other details, or to study a year or two at a law school, under the guidance and instruction of the highest lights in the profession, where he will see little of the details of practice, to be sure, but where he can hardly fail, if he has any application at all, to obtain a widely extended general view of the great principles which underlie the whole structure of the profession, and where he can occupy himself "in tracing out the originals, and, as it were, the elements of the law," and afterwards go into an office and become familiar with the routine of practice?

Some would answer in one way, no doubt, and others in another. Some might regard the time at the law school as comparatively thrown away; others would esteem it as of the utmost importance. The latter would justify it by saying that the broad groundwork of general principles which the school would give the young man, would be of untold value in all the emergencies of after practice, while, ten chances to one, if he began with the details of practice, he would never rise to general principles. In the former case, after becoming familiar with general principles, a familiarity with practice must be obtained, as a matter of course, as every thing depends upon it.

It would be unfair, I think, to assert that the advocates of university teaching in Germany undervalue practice. If I understand their position, it is that the union of the highest education in the sciences and in the practice, is incompatible at the same time and in the same school, and they advise the pupil to begin at the fountain head and become well grounded in the scientific principles, and then to go on to a farm under a competent, practical man, and learn the details of farm management.

If this is a correct statement of their position, the idea of commencing in a lower grade school with the intention of going up into the higher scientific institute afterwards, as a sort of finishing off of their education, is equally impracticable; that is, according to them, it would be beginning at the wrong end. Whether they are correct or not, it is not for me to say; but I give it as the result of their long experience, and of their thought and observation upon the subject, and as such worthy of careful consideration in establishing similar institutions with us.

I do not know that it would serve any good purpose to enter at length into a development of the controversy now going on in Germany upon this question, owing to the fact, already intimated, that the state of society is so different, the lines of caste there so nicely drawn, and the objects proposed in an agricultural education so distinct from our own. But it may be remarked that Liebig has taken the ground very strenuously in favor of a connection with the universities, and that a great majority of the agriculturists adopt that view, or take a middle ground, that the location should be in the immediate vicinity of some established university, partly as a means of bringing the students under university laws, and partly as a means of giving the professors a higher position in the estimation of their pupils, and of availing themselves of the advantages of the collections, libraries, &c., which a university can offer, as well as of the talent of university professors. Volumes have been written upon the subject.

The question in favor of the universities has been fully stated in a work of 200 pages octavo, by Dr. Birnbaum of the University of Giessen, entitled *The Universities and Isolated Agricultural Institutes*, Giessen, 1862. He sums up in the following propositions:—

(1.) The simultaneous application of the practical skill requisite for management and the theoretical knowledge necessary for understanding the business, is inadmissible, and for teachers and pupils alike impracticable.

(2.) The practicing farmer, the practical man, is, as a rule, in all cases in which he directs his estate, not quite adapted to give instruction, not suitable as a teacher for beginners, but indeed—capacity and desire aside—to be recommended as a

model and pattern for trusty young farmers well grounded in the elements.

(3.) Good schooling is most important at present for the farmer, and must therefore not be interrupted before the age of seventeen.

(4.) After suitable schooling the learning of the practice can be begun on such middling and smaller estates where the chief design is the education of young farmers, and where only a number of scholars proportioned to the circumstances of the farm are taken. When the instruction is finished through the assistance of schools where the languages and the applied sciences are taught, and others, nothing further will remain.

(5.) After a stay of one or two years in such a practical preparatory school, it is most judicious for the young man to serve some time as volunteer or under steward on a larger estate.

Now and then a change is to be recommended, though not too frequently.

(6.) Only well-trained young men should be admitted into the higher institutes.

(7.) The higher institute should have in view only the scientific training, such as answers for the higher development of the profession and science.

(8.) The most judicious location is therefore the university, in case a capable corps of instruction and requisite apparatus can be furnished.

(9.) The establishment of chairs of agriculture at the universities, and their adequate endowment, should be desired for the agricultural interest, as well as for all others.

(10.) The connection of scientific or other agricultural institutes with large estates, is only useful when these are carried on quite independently by themselves, and either the director, or perhaps one of the professors, has the management of the domain.

(11.) The farm property so situated will most judiciously be carried on as a model establishment, but in this case, without regard to the institute, and to secure respect, it should issue the most complete public accounts. Such an establishment need not be located in immediate connection with the institute of instruction, and may be from five to eight miles away.

(12.) A place and location for experiments, the special field of instruction belonging to the institute, should not be wanting, yet it should serve only for the purposes of science and instruction, and therefore not be carried on with reference to the highest profit.

(13.) The professors of agriculture should be fitly educated, practically and scientifically, and be appointed only on the ground of this special fitness.

(14.) The present stand-point of science requires the appointment of special professors for the more important auxiliary branches, and the holding of several departments by one person is impracticable.

(15.) The teaching of the auxiliary sciences is judicious for farmers, but never should be given as the so-called agricultural science.

(16.) The course of instruction in agriculture can be completed in two years only in case of a good preparatory education to begin with. Those less thoroughly prepared will have to devote one or more extra terms to the study of the auxiliary sciences. Institutes which profess to teach the whole of agriculture to those imperfectly prepared, in two years, are worthy of no confidence.

(17.) The student of agriculture must have full control of his actions, like other students, and not feel under restraint.

(18.) The connection of lower grade schools (where the pupils do the work) with the higher institutes, is to be rejected.

(19.) It is desirable, if the institutes are connected with universities, and properly founded and endowed, to have experimental stations, adequately endowed, created in connection with them.

(20.) The maintenance of institutes located from financial or other reasons in connection with a university, appears then the more secure, if reorganized and carried on according to this plan.

The great majority of what are called agricultural schools in Europe are mere manual labor schools, and on a very limited scale at that. In Ireland alone there are one hundred and thirty-four such schools. France has three regional schools on the same footing as that at Grignon, though I believe the two others are not quite so flourishing, one agronomic institute at

Versailles, and many inferior schools, carried on in a small way, where, in addition to the elements of education, more or less instruction is given in agriculture, and where the pupils have to work; and this is the case in many other continental countries. In some of their schools the preponderance of other studies is so great that it is not easy to see why they are called agricultural schools. There are, besides, many special schools which are frequently called agricultural schools; as, for instance, the school for the management of forests, at Thärand.

It is desirable that we should fix in our minds some definite aim and develop beforehand the precise object that we wish to attain; that is, whether we shall establish a college on the plan of the higher scientific institutes abroad, or on that of the schools of practice, contenting ourselves with a lower scale of scientific attainment for the sake of the advantages of a more skilful, and perhaps a more enlightened practice. It is hardly reasonable to expect, if we may judge from the experience in other countries, to make thoroughly scientific agriculturists in the course of two or three, or even four years, if a large part of the time of the pupil is to be devoted to manual labor on the farm. At the same time it may be said that we do not wish to educate our sons so as to make them feel above work on the farm. No school that accomplished such a result would long commend itself to the confidence of the people.

The work of deciding this question satisfactorily and of carrying into operation a scheme of such magnitude as that now proposed in most of the loyal States of the Union is one of great difficulty and responsibility, and one in which the parties on whom the responsibility rests will need the confidence, the forbearance and the cordial coöperation of the people. It will require caution, judgment and practical wisdom, on the one hand, and a candid appreciation of the difficulties and the entertainment of reasonable expectations, on the other. It will require faith in the application of science to the improvement of practice. We know that it has elevated other arts, improved the appliances of labor and cheapened the production of the necessaries of life. Why should it not lead, within a reasonable time, to more enlightened processes of farm-work, bring mind and thought to bear upon the labors of the hand, and infuse new spirit into the whole farming community?